

EVALUATION OF THE CRITERIA  
GOVERNING THE  
GROUNDWATER PROTECTION AND  
MONITORING PROGRAM  
AT THE ROCKY FLATS PLANT

Prepared for  
the Geosciences Division of  
Environmental Restoration Management of  
EG&G

Prepared by  
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## EXECUTIVE SUMMARY

## EXECUTIVE SUMMARY

### I. INTRODUCTION

An independent review of the groundwater monitoring and protection program at the Rocky Flats Plant (RFP) was conducted by Wright Water Engineers, Inc (WWE) for the Geosciences Division of Environmental Restoration Management (ERM). WWE was asked to assess the program against criteria in a Department of Energy (DOE) document entitled, *Performance Objectives and Criteria for Conducting DOE Environmental Audits* (DOE, 1993d). A portion of this document describes four general objectives for protection of groundwater that must be met by every DOE facility. The four general objectives are as follows:

- GW1 Groundwater protection management program,
- GW2 Groundwater monitoring program,
- GW3 Sitewide groundwater monitoring well network, and
- GW4 Hydrogeologic characterization of RCRA and/or CERCLA sites

Within each of the four objectives, 30 specific criteria are outlined which must be met to fulfill the general objective requirements. WWE assessed compliance with each of the 30 criteria, as well as four additional criteria requested by the Geosciences Division.

Degree of compliance for each criteria, as judged by WWE, is shown in Table 1 (located at the end of the Executive Summary). Each criteria is summarized by a brief phrase in Table 1. The complete criteria can be found in the body of the report.

For each finding in this Executive Summary, the specific criteria to which it applies is referenced parenthetically. The reader is thereby referenced to the detailed discussion of these findings in the main body of the report.

## II. GENERAL FINDINGS

The overall groundwater protection and monitoring program successfully meets the goals of a well-documented and technically sound program as outlined in DOE Order 5400.1 (included as Appendix A). The formal structures are in place for relevant subprograms within the overall groundwater protection program to conduct self-examination and modification when necessary. These subprograms include development of a *Groundwater Protection and Monitoring Program Plan* (GPMPP) (EG&G, 1993e), the field and laboratory procedures as outlined in Standard Operating Procedures (SOPs), various hydrologic and hydrogeologic characterization efforts, and the data management system. The overall groundwater program is well-summarized and evaluated in a recent draft report entitled *Well Evaluation Report Draft* (S. M. Stoller Corporation, et al., 1993).

Personnel involved in the groundwater protection and monitoring program demonstrated enthusiasm and competence in working toward the goals of the program. Our single most important finding is that their efforts are significantly hindered by the lack of formal coordination among various EG&G organizations which inhibits the execution of a cohesive, efficient and cost-effective groundwater protection and monitoring program.

Professional communication and coordination regularly occurs at RFP on an informal basis. However, there is no high-level policy document to communicate the responsibilities of the groundwater program to other organizations in a form which requires coordination of activities for the purpose of ensuring groundwater protection. As examples, there is lack of communication between the Surface Water and Groundwater Divisions on foundation water quality issues (see Criteria 32), there is an omission of information in data entered into the Rocky Flats Environmental Database System (RFEDS) which is essential for proper statistical analysis (see Criteria 34), and there is lack of coordination between engineering design activities and groundwater protection functions (see Criteria 9).

In addition, organizational structure and the division of responsibilities in ERM impedes information transfer to non-project-related individuals. Of particular importance to ERM is the fact that reports generated by the Geosciences Division are not routinely transmitted to Operable

Unit (OU) managers or other interested parties, and vice-versa. As a case in point, the vertical gradient studies which were conducted by the Geosciences Division at OUs 1 and 2 were never incorporated into a report which was widely distributed to the OU 1 and 2 project teams (see Criteria 18)

### **III. SUMMARY OF FINDINGS: OBJECTIVE GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

The GPMPP is a comprehensive document which clearly and thoroughly outlines regulatory requirements necessary for the RFP groundwater monitoring program (see Criteria 1). The groundwater monitoring program at RFP has gone beyond the mandated requirements to meet non-binding recommendations from external organizations such as the Rocky Flats Environmental Monitoring Council and the Governor's Rocky Flats Scientific Panel. The document is only required to be updated every three years but is updated annually (see Criteria 2).

The GPMPP does, however, contain some outdated and incomplete information (see Criteria 3 and 5), and does not contain the required descriptions of organizational responsibilities (see Criteria 4). It also does not reflect the level of uncertainty associated with tracking past installation of groundwater monitoring wells nor what mechanisms are currently employed to ensure that all wells are properly documented (see Criteria 6, 22 and 23). Another finding is that recommended program improvements rarely include schedules for completion (see Criteria 8).

### **IV. SUMMARY OF FINDINGS: OBJECTIVE GW2 GROUNDWATER MONITORING PROGRAM**

General compliance with Resource Conservation and Recovery Act (RCRA) groundwater monitoring requirements is demonstrated for the three regulated units (OUs 4, 7 and 11). However, a better understanding and further characterization of the hydrogeology at the three regulated OUs is strongly recommended. Given the complexity of the subsurface geology at

RFP, detection of constituent migration is questionable with the existing monitoring well network at each of these three regulated units (see Criteria 15)

SOPs contain extensive detail and include virtually all activities within the groundwater monitoring program, with minor exceptions. Specific deficiencies were identified and are discussed in the body of the report (see Criteria 13 and 25)

Oversight of laboratory performance is well managed and well documented, and is flexible enough to adjust to the dynamics of regulatory requirements for laboratories (see Criteria 13 and 14)

Required training programs are implemented and training records are maintained (see Criteria 14)

The requirement for third-party validation of 100 percent of lab data might be simplified by the inclusion of known standard samples (blinds) among the samples submitted for analysis. The present procedure may be redundant and cannot detect certain types of lab errors (see Criteria 13)

## **V. SUMMARY OF FINDINGS: OBJECTIVE GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

The regional surface and subsurface geology, stratigraphy and hydrostratigraphy of RFP are generally well defined and have been since as early as 1976. Microscale characterization has occurred in certain areas of the industrial area and its boundary. This better definition is the result of numerous boreholes and monitoring wells established to characterize potential contaminant pathways at OUs 1, 2 and 4 (see Criteria 16)

Although planned for 1994, little effort has been directed toward correlation of site-specific data obtained from OU and other studies to a sitewide understanding of the surface and subsurface geology. For example, concerns exist regarding the potential for migration of contaminants

through continuous sand units or channel complexes within bedrock formations and/or through faults or fracture systems which might have created more permeable contaminant pathways to deeper hydrogeologic units (see Criteria 16). Characterization on a sitewide basis of the faults and fracture systems at RFP using site-specific information has not been performed, and would improve the understanding of overall contaminant transport (see Criteria 16, 17 and 27).

Most of the geologic and hydrogeologic characterization work has appropriately focused on the unconsolidated surficial deposits (Rocky Flats Alluvium, colluvium, and valley-fill alluvium) and the immediately underlying bedrock units of the Arapahoe and Laramie formations. These geologic units are of most concern for contaminant transport because the underlying bedrock has significantly lower hydraulic conductivities. However, additional limited information should be obtained for the deeper bedrock units including an analysis of vertical gradients and fault and fracture delineation and connectedness. Moreover, a sitewide study which evaluates and unifies all hydraulic conductivity tests performed at RFP needs to be conducted (see Criteria 18 and 19).

Little effort has been made to conduct a hydrologic mass balance study for RFP. This is judged to be of paramount importance in characterizing the sitewide hydrogeology (see Criteria 16). A sitewide mass balance using information obtained from OU-specific and other local studies could be used in a groundwater modeling program to predict such phenomena as surface water/groundwater interaction, recharge to groundwater and contaminant plume movement (see Criteria 26).

Piezometric surface maps and groundwater flow paths for the uppermost hydrostratigraphic units, which include the unconsolidated alluvial material, the colluvial material and the weathered bedrock, have been constructed for isolated time periods. Insufficient information has been obtained from wells constructed in the deeper bedrock units to generate the equivalent maps. Water level data collected on a quarterly basis should be evaluated and mapped on a regularly scheduled basis (see Criteria 17).

Geophysical techniques have been used to assist in the characterization of the sand units and channel complexes identified in the shallow bedrock. Limited boreholes have been constructed to independently verify the successful delineation of sandstone units using geophysical techniques.

Surficial techniques to define geologic features that control groundwater migration are questionable unless validated by borehole data (see Criteria 17)

Using appropriate field tests, a substantial amount of data was generated regarding quantification of hydraulic conductivity, transmissivity and saturated thickness. Validation of the accuracy of these data is needed (see Criteria 19)

Additional wells along Indiana Street are needed to characterize and track potential offsite migration of contaminants. These wells should be appropriately screened to differentiate between the upper and lower hydrostratigraphic units so that water quality and water gradients can be accurately determined for each of these units. Additional upgradient wells near the western property boundary are also recommended to determine the effects of the subcropping Fox Hills formation on groundwater flows entering RFP (see Criteria 20)

There is an ongoing program at RFP to fully document on-site monitoring wells (see Criteria 22). A program also exists which plugs and abandons those wells which cannot be fully documented (see Criteria 23). A review of SOPs found that, except for routine monitoring for sediment accumulation, guidelines or procedures governing the recording or tracking of well inspection and maintenance data do not exist (see Criteria 25)

No groundwater flow model has been used to establish or to evaluate the monitoring well network. A sitewide groundwater flow model exists and is currently being calibrated. The sitewide flow model uses reputable public-domain software which ensures that computer code testing has been conducted. Future groundwater flow model studies would benefit from the mass balance study, which was previously mentioned, and could be used to predict the rate and extent of contaminant plume migration and to assist in determining appropriate well placement (see Criteria 26)

## **VI SUMMARY OF FINDINGS: OBJECTIVE GW4 HYDROGEOLOGIC CHARACTERIZATION OF RCRA AND/OR CERCLA SITES**

Written plans for hydrogeologic characterization of RCRA and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites at RFP have been prepared in accordance with Interagency Agreement (IAG) requirements. These plans are delineated and documented in work plans for specific, identified OUs and in background characterization documents designed to obtain hydrogeologic characterization data applicable to the entire RFP site (see Criteria 27). Hydrogeologic characterization efforts at individual OUs are generally conducted independently of sitewide efforts, with little coordination between individual OUs and the sitewide groundwater monitoring program (see Criteria 27).

Well coverage in the Industrial Area appears inadequate to completely characterize all individual IHSSs or to characterize under-building contamination. Additional hydrogeologic characterization within the Industrial Area is recommended (see Criteria 27).

Characterization of off-site contamination resulting from on-site sources and events has been completed and no additional off-site characterization is planned. All major on-site sources of contamination have been identified. However, sources associated with buildings within the Industrial Area have not been located precisely enough to be remediated and/or controlled (see Criteria 28).

In general, the rate and extent of groundwater contaminant migration has been defined on an individual OU-basis. An exception is in the Industrial Area, where the close proximity and overlapping nature of many OUs makes this task difficult. The current network of monitoring wells within the Industrial Area does not allow the determination of potential cross-contamination between different OUs (see Criteria 30).

## **VII SUMMARY OF FINDINGS: ADDITIONAL CRITERIA**

The Geosciences Division currently does not have an internal mechanism to track regulatory changes that may impact groundwater protection and monitoring programs (see Criteria 31)

Extensive individual source control programs exist that were developed as part of a general environmental protection strategy but were designed to specifically address groundwater protection. However, a single, unified source control program does not exist. The source control programs which do exist are not adequately coordinated with the groundwater monitoring program. For example, information from the tank management program is not routinely provided to the groundwater program personnel (see Criteria 32)

Although it appears that an appropriate management structure exists and appropriate data management systems are in place for source control, both areas suffer from fragmentation of responsibility and a general lack of coordination among groups. Implementation of source control programs for the protection of groundwater would be improved by additional mapping of activities and facilities that potentially impact groundwater, and from better communication of groundwater-related information generated by other programs to the Geosciences Division (see Criteria 33)

The data management system is undergoing continuous evolutionary improvement. The useability of the data entered into the RFEDS system prior to 1992 needs to be upgraded to the standards of the more recent data (see Criteria 34)

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931-057 050  
(RF/GW/ExecSum)



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Re Deliverable for Contract MTS 229979TH (Modification)

Dear Steve

Attached is the report specified as a deliverable under the subject MTS contract, *Evaluation of the Criteria Governing the Groundwater Protection and Monitoring Program at the Rocky Flats Plant*. This report was requested by the Geosciences Division under the modification to the subject MTS contract.

This report reflects comments made on the December 10, 1993 draft version by Mark Levin, Steve Singer, Tim Lovseth, Rob Smith, Connie Dodge, Barry Roberts, Melanie Mills of Arnold & Porter and you. We feel this document has benefited greatly from such careful review, and have appreciated the participation of those involved.


For this review, members of the Wright Water Engineers, Inc (WWE) team included


- Jonathan Jones, Project Manager
- Eric Bikis, Co-Task Manager
- Frank Blaha, Co-Task Manager
- Robert Weiner, Senior Chemist
- Johanna Miller, Regulatory Specialist
- Eric Mende, Senior Project Engineer
- Gary Witt, Hydrogeologist
- Chris Woods, Senior Geologist
- Tim Axley, Geologist

WWE is also providing a copy of this report to Steve Singer and Mark Levin of EG&G Rocky Flats, Inc. As always, we have enjoyed working with you on this project.

Very truly yours,

**WRIGHT WATER ENGINEERS, INC.**

  
Jonathan E. Jones, P.E., Project Manager

  
Eric A. Bikis, P.G., Co-Task Manager


  
Frank Blaha, P.E., Co-Task Manager

TABLE 1

## SUMMARY OF COMPLIANCE WITH DOE AUDIT CRITERIA

## OBJECTIVE GW 1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM

#	CRITERIA DESCRIPTION	0	1	2	3	4	5
1	Preparation of Groundwater Management Plan (GWMP)					X	
2	Annual review and update of GWMP						X
3	Hydrogeologic setting described in GWMP					X	
4	Organizational chart in GWMP		X				
5	Pertinent documents referenced in GWMP					X	
6	Description of well network in GWMP					X	
7	GWMP includes a groundwater monitoring program						X
8	GWMP describes upgrades to meet 11/9/91 requirements				X		
9	Plans for coordination of all plant activities with GWMP		X				

0 = No compliance

5 = Complete compliance

**TABLE 1**  
**SUMMARY OF COMPLIANCE WITH DOE AUDIT CRITERIA**  
(Continued)

**OBJECTIVE GW 2 GROUNDWATER MONITORING PROGRAM**

#	CRITERIA DESCRIPTION	0	1	2	3	4	5
10	Groundwater Monitoring Plan (GWMoP) exists						X
11	GWMoP identifies regulations and monitoring details					X	
12	Sampling and Analysis Plan exists for sitewide program			X			
13	Approved SOPs for sampling and analysis					X	
14	Adequate training of sampling and analysis team					X	
15	Compliance with RCRA requirements documented			X			

0 = No compliance  
5 = Complete compliance

**TABLE 1**  
**SUMMARY OF COMPLIANCE WITH DOE AUDIT CRITERIA**  
(Continued)

**OBJECTIVE GW 3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

#	CRITERIA DESCRIPTION	0	1	2	3	4	5
16	Characterization of surface & subsurface geology					X	
17	Characterization of groundwater flow (horizontal)				X		
18	Characterization of groundwater flow (vertical)			X			
19	Hydrogeologic parameters are field-tested and checked			X			
20	Characterization of up and down-gradient water quality to detect off-site releases					X	
21	Well locations justified				X		
22	Well construction documented					X	
23	Well abandonment documented					X	
24	Well inspection and maintenance documented		X				
25	SOPs for well construction					X	
26	Acceptable GW models					X	

0 = No compliance  
5 = Complete compliance

**TABLE 1**  
**SUMMARY OF COMPLIANCE WITH DOE AUDIT CRITERIA**  
(Continued)

**OBJECTIVE GW 4 HYDROGEOLOGIC CHARACTERIZATION OF RCRA AND CERCLA SITES & ADDITIONAL CRITERIA**

#	CRITERIA DESCRIPTION	0	1	2	3	4	5
27	Plans for investigation of IHSSs					X	
28	All potential contaminant sources identified					X	
29	Contaminants of Concern identified						X
30	Extent of groundwater contamination defined at OUs					X	
31	10 CFR 834/Regulatory Tracking					X	
32	Source control programs exist			X			
33	Ensured implementation of source control programs				X		
34	Site-wide data management system				X		

0 = No compliance  
5 = Complete compliance

## INTRODUCTION

## INTRODUCTION

### I. PURPOSE AND SCOPE OF PROJECT

The purpose of this project is to assess the compliance of the Rocky Flats Plant (RFP) groundwater monitoring and protection programs with the *Performance Objectives and Criteria for Conducting Department of Energy (DOE) Environmental Audits* (DOE, 1993d). This document lists four general performance criteria and 30 specific criteria for protection of groundwater at DOE facilities. In addition to these thirty specific criteria, four additional criteria critical to groundwater protection were also evaluated at the request of EG&G personnel. Evaluation of the existing program against these criteria allows the identification of areas in which the groundwater program meets or exceeds relevant requirements, as well as those areas in which the groundwater program is in need of improvement. This evaluation is intended by EG&G Rocky Flats, Inc. to be a proactive assessment of the groundwater program. Problems and areas of concern identified in this study will be used by EG&G to target key areas for improvement and to efficiently allocate resources in the future.

The responsibility of the EG&G Geosciences Division is to ensure that site operations are in compliance with the comprehensive program for groundwater protection mandated by DOE Orders and with other legally enforceable requirements. These requirements are found in EPA regulations based on the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Safe Drinking Water Act (SDWA), and the Clean Water Act (CWA), state statutes and regulations, and local ordinances. Permits, court orders, consent orders, Federal Facility Compliance Agreements, or other compliance agreements may also create legally enforceable requirements for a particular site. Applicable regulatory drivers are shown in Table 2, located at the end of the Introduction. The DOE requirements apply even if no contaminant releases to the environment are known to have occurred, and even if no RCRA facilities or CERCLA actions that involve groundwater monitoring are present.

A meeting was then held with EG&G management having responsibility for the groundwater monitoring and protection program. The purpose of this meeting was two-fold: to discuss the understanding of each criteria with knowledgeable EG&G personnel, and to further identify pertinent documents and contacts for each criteria.

Immediately following the review meeting with EG&G, the project team began to research and evaluate each criteria. This research emphasized the current situation (a snapshot in time) and existing documentation, especially program plans, standard operating procedures (SOPs), quality assurance documents, and reports of investigations. These documents provided the framework for an initial understanding and assessment of the adequacy of the program. This understanding and initial assessment was typically supplemented by interviews of EG&G personnel with programmatic control or oversight of the activities being evaluated. Detailed notes of documents reviewed and personnel interviewed were maintained throughout the project. As research was conducted, the written report for each criteria was prepared by the individual or team responsible for that criteria.

The complexity and extent of the groundwater program, as well as the overlap between some of the criteria of the audit, made it necessary that the project team, as a whole, review and comment on the team findings for each criteria. This final team review helped to focus the written responses to each criteria, eliminate redundancy and overlap in the project team findings and identify and reference related criteria.

### **III. SCOPE AND LIMITATIONS OF ASSESSMENT**

This assessment of the groundwater protection and monitoring program has been conducted on a "programmatic" basis. Thus, it included a review of environmental regulations, DOE orders, and conformance to accepted industry standards, as well as a review of whether the programs and systems are sufficient to reasonably assure that environmental compliance is achieved. The programmatic approach focuses on the formal systems and programs used by RFP to establish and implement environmental protection activities. Where the programs and formal systems are found to be reasonably comprehensive, inclusive, and properly focused, then it is probable that

environmental protection and compliance with minimum regulatory requirements will be achieved in the future. However, all detailed regulatory requirements must be met, both now and in the future, and this approach attempts to identify actual and potential deficiencies. Nevertheless, this is an assessment of the current situation, and problems identified during this evaluation are discussed in our findings regardless of whether RFP expects to address or correct the problem in the future. Similarly, in keeping with a programmatic assessment, we did not attempt to identify specific locations for new wells or total numbers of new wells that might be needed. These specific technical issues will be properly addressed if there exist adequate programmatic requirements and adequate programmatic understanding of the technical issues.

The criteria identified for this project are quite comprehensive. Many of these criteria, especially those that used terms such as "all" or "fully," required the project team to judge compliance with broad objectives. Many of these issues are highly technical and site-specific, and there is no guidance available that can ever reduce assessment of compliance on some of these issues to a mere counting activity. The project team assessed these issues from the standpoint of a "reasonable person." The project team as a whole agreed upon the meaning of "all" or "fully" for each criteria, and these definitions are presented in the discussion section of the final report. Depending on their background and personal focus, some individuals may disagree with the project team's interpretation of these issues. Nonetheless, the project team feels confident that the interpretation of these issues is reasonable for a detailed compliance assessment.

For instance, the DOE orders require that groundwater monitoring be conducted at the upgradient and downgradient boundaries of DOE sites. This monitoring is intended to determine whether upgradient contamination is affecting the DOE facility as well as whether the DOE facility is affecting downgradient groundwater quality. Thus, the mere presence of upgradient and downgradient boundary groundwater monitoring wells is not sufficient to establish compliance with this requirement. This determination can only be made if the typical macroscopic flow regime of the facility is understood (such as west-to-east groundwater flow being typical) as well as specific flow regimes at each boundary location (such as the existence of paleochannels that cause localized flow in a direction other than typical flow patterns). Compliance with this requirement can only be achieved if a sufficient number of wells are completed in appropriate locations, and are screened at proper depths, to be *reasonably* sure of detecting contamination at

the upgradient and downgradient boundaries. The evaluation of the reasonableness of the boundary monitoring must be based upon a technical evaluation of both the general and specific flow regimes.

The emphasis of our review was on written documentation. If no written record of an activity required by one of the criteria exists, then this assessment considered this issue to not be fully addressed. An example of this situation is well inspections. Although the water level measurement forms have a comments section for field personnel to document well inspection, no SOP requires a comprehensive inspection. Field personnel do not always specifically inspect each well during field activities, nor do maintenance problems noted get formally tracked. Thus, although at times problems with wells are noted on field forms, it is felt by the project team that a documentation deficiency exists in the well inspection area.

Since this was a programmatic assessment, time was not spent in the field reviewing field procedures and practices unless required to establish compliance with a criteria. Typically, written SOPs that govern field activities were reviewed instead, and compliance with written SOPs and field forms by field personnel was assumed. Furthermore, it is the project team's understanding that compliance of field activities with relevant SOPs is already reviewed by other internal and external RFP Quality Assurance audit teams, so if SOPs are adequate, field practices should also be adequate.

#### IV. DOCUMENT ORGANIZATION

The evaluation of each criteria is presented in the following section. For each criteria, the following information is provided:

- I Criteria - A restatement of the criteria as published in the *Performance Objectives and Criteria for Conducting DOE Environmental Audits*
- II Primary Regulatory Driver - A listing of the regulations pertinent to the criteria

III Basis of Opinion - Those documents reviewed and personnel interviewed in evaluating compliance with the criteria If needed, the project team's interpretation of each criteria is provided

IV Findings - The project team's detailed findings regarding the criteria

(CRFPGWIntro)

TABLE 2

## REGULATORY DRIVERS FOR GROUNDWATER MONITORING AND PROTECTION REQUIREMENTS AT RFP

## OBJECTIVE GW 1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM

#	CRITERIA DESCRIPTION	DOE 5400 1	DOE 5400 3 (RCRA Compliance)	DOE 5400 4 (CERCLA Compliance)	DOE 5700 6C (Quality Assurance)	RCRA & CHWA	CERCLA	CWA	SDWA	CWQCA	AIP	IAG	SEO	SOP's
1	Preparation of Groundwater Management Plan (GWMP)	X												
2	Annual review and update of GWMP	X												
3	Hydrogeologic setting described in GWMP	X												
4	Organizational chart in GWMP	X												
5	Pertinent documents referenced in GWMP	X												
6	Description of well network in GWMP	X												
7	GWMP includes a groundwater monitoring program	X												
8	GWMP describes upgrades to meet 11/9/91 requirements	X												
9	Plans for coordination of all plant activities with GWMP	X												

TABLE 2

**REGULATORY DRIVERS FOR GROUNDWATER MONITORING AND PROTECTION REQUIREMENTS AT RFP**  
(Continued)

**OBJECTIVE GW 2 GROUNDWATER MONITORING PROGRAM**

#	CRITERIA DESCRIPTION	DOE 5400.1	DOE 5400.3 (RCRA Compliance)	DOE 5400.4 (CERCLA Compliance)	DOE 5700.6C (Quality Assurance)	RCRA & CHWA	CERCLA	CWA	SDWA	CWQCA	AIP	IAG	SFO	SOPs
10	Groundwater Monitoring Plan (GWMoP) exists	X												
11	GMoP identifies regulations and monitoring details	X	X	X		X	X	X	X	X	X	X	X	
12	Sampling and Analysis Plan exists for sitewide program	X			X	X						X		X
13	Approved SOPs for sampling and analysis	X			X									X
14	Adequate training of sampling and analysis team	X			X									X
15	Compliance with RCRA requirements documented	X	X			X						X		X

TABLE 2

**REGULATORY DRIVERS FOR GROUNDWATER MONITORING AND PROTECTION REQUIREMENTS AT RFP**  
(Continued)

**OBJECTIVE GW 3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

#	CRITERIA DESCRIPTION	DOE 5400 1	DOE 5400 3 (RCRA Compliance)	DOE 5400 4 (CERCLA Compliance)	DOE 5700 6C (Quality Assurance)	RCRA & CHWA	CERCLA	CWA	SDWA	CWQCA	AIP	IAG	SEO	SOPs
16	Characterization of surface & subsurface geology	X												
17	Characterization of groundwater flow (horizontal)	X												
18	Characterization of groundwater flow (vertical)	X												
19	Hydrogeologic parameters are field-tested and checked	X												
20	Characterization of up and down-gradient water quality to detect off-site releases	X												
21	Well locations justified	X												
22	Well construction documented	X											X	X
23	Well abandonment documented	X											X	X
24	Well inspection and maintenance documented	X												
25	SOPs for well construction	X												X
26	Acceptable GW models	X												

TABLE 2

**REGULATORY DRIVERS FOR GROUNDWATER MONITORING AND PROTECTION REQUIREMENTS AT RFP**  
(Continued)

**OBJECTIVE GW 4 HYDROGEOLOGIC CHARACTERIZATION OF RCRA AND CERCLA SITES & ADDITIONAL CRITERIA**

#	CRITERIA DESCRIPTION	DOE 5400.1	DOE 5400.3 (RCRA Compliance)	DOE 5400.4 (CERCLA Compliance)	DOE 5700.6C (Quality Assurance)	RCRA & CHWA	CERCLA	CWA	SDWA	CWQCA	AIP	IAG	SEO	SOPs
27	Plans for investigation of IHSSs	X	X	X		X	X					X		
28	All potential contaminant sources identified	X	X	X		X	X					X		
29	Contaminants of Concern identified	X	X	X		X	X			X		X		
30	Extent of groundwater contamination defined at OUs	X	X	X		X	X				X	X		
31	10 CFR 834	X												
32	Source control programs exist	X									X			
33	Ensured implementation of source control programs	X												
34	Site-wide data management system													

TABLE 2

REGULATORY DRIVERS FOR GROUNDWATER MONITORING AND PROTECTION REQUIREMENTS AT RFP  
(Continued)

Definitions

DOE Order 5400 1 =	General Environmental Protection Program
DOE Order 5400 3 =	Hazardous and Radioactive Mixed Waste Program
DOE Order 5400 4 =	Comprehensive Environmental Response Compensation & Liability Act Requirements
DOE Order 5700 6C =	Quality Assurance
RCRA =	Resource Conservation Recovery Act
CHWA =	Colorado Hazardous Waste Act
CERCLA =	Comprehensive Environmental Response, Compensation and Liability Act
CWA =	Clean Water Act
SDWA =	Safe Drinking Water Act
CWQCA =	Colorado Water Quality Control Act
AIP =	Agreement in Principle
IAG =	Interagency Agreement
SEO =	State Engineer's Office
SOPs =	Standard Operating Procedures

(CRFPA/GW/GWTable 2)

GROUNDWATER  
CRITERIA COMPLIANCE  
REVIEW

## **GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

### **OBJECTIVE REQUIREMENT**

DOE 5400 1 - General Environmental Protection Program, Chapter III, Environmental Protection Program Plans, in a statement of policy, establishes requirements for DOE operations to develop and implement specific program plans

DOE 5400 1, Chapter III, Section 4 a, requires that a specific program plan, the Groundwater Protection Management Program Plan, be in place by May 9, 1990. This Plan must be reviewed annually and updated every three years

### **I. CRITERIA**

1. A formal, documented Plan was prepared by May 9, 1990, that describes a Program to develop, or cause to happen, all the elements specified in DOE 5400.1, Chapter III, Section 4.a that comprise a Groundwater Protection Management Plan.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Final Groundwater Protection and Monitoring Program Plan (EG&G, 1991b)*

*Draft Groundwater Protection and Monitoring Program Plan (EG&G, 1992b)*

*Groundwater Protection and Monitoring Program Plan (EG&G, 1993e)*

#### **Discussion:**

This criteria requires that a formal plan be in place that describes the programs in place or planned that will address the elements of Department of Energy (DOE) Order 5400 1, Chapter III, Section 4a

The adequacy of the programs to address each element is not evaluated in this criteria, but is addressed in Criteria 16, 28 and 32. The elements required in the plan are as follows: (1) documentation of the groundwater regime with respect to quantity and quality, (2) design and implementation of a groundwater monitoring program to support resource management and comply with applicable environmental laws and regulations, (3) a management program for groundwater protection and remediation, including specific Safe Drinking Water Act (SDWA), Resource Conservation & Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) actions, (4) a summary and identification of areas that may be contaminated with hazardous substances, (5) strategies for controlling sources of these contaminants, (6) a remedial action program that is part of the site CERCLA program required by DOE 5400.4, and (7) decontamination and decommissioning and other remedial programs contained in DOE directives.

#### IV. FINDINGS

The Rocky Flats Plant (RFP) has successfully fulfilled this criteria through publication of a series of *Groundwater Protection and Monitoring Program Plans* (GPMPPs). A draft GPMPP was submitted to DOE for review in late May of 1990. This draft was revised and issued for public comment in July of 1991 and was published in final form on November 27, 1991. Because the first draft version of the GPMPP was completed in late May, 1990, the May 9, 1990 deadline in DOE Order 5400.1 was not met.

Findings regarding the elements requiring description in the plan are discussed separately, below.

1. Documentation of the groundwater regime with respect to quantity and quality  
Section 4.3 of the GPMPP describes the groundwater monitoring conducted to characterize the quantity of groundwater in the vicinity of RFP. This section, however, provides little discussion of how water level data are analyzed after collection. (Section 2.3.3 states that the surface water and groundwater monitoring programs will eventually quantify losing and gaining reaches of streams and ditches, but does not provide details on when or how this will occur or refer to specific documents which outline the approach to be taken.) Multiple sections address monitoring activities designed to characterize the groundwater quality including references to the various CERCLA and RCRA programs.
2. Design and implementation of a groundwater monitoring program to support resource management and comply with applicable environmental laws and regulations  
The GPMPP adequately discusses the design and implementation of the groundwater monitoring program and the regulatory requirements that trigger

groundwater monitoring activities. Regulatory requirements for groundwater protection, with the exception of DOE Order 5400.1, are included in the GPMPP.

- 3 A management program for groundwater protection and remediation, including SDWA, RCRA and CERCLA actions. RCRA and CERCLA portions of this element are adequately described in the most recent GPMPP, however, SDWA is not addressed as required. The GPMPP should note that SDWA does not have groundwater monitoring requirements that are applicable at RFP.
- 4 A summary and identification of areas that may be contaminated with hazardous substances. This element is described in Section 1.8 of the GPMPP.
- 5 Strategies for controlling sources of these contaminants. This element is adequately described in Chapter 4.0 of the GPMPP. See Criteria 3.2 for a discussion of the adequacy of source control programs.
- 6 A remedial action program that is part of the site CERCLA program. This element is adequately described in several chapters of the GPMPP. The GPMPP provides a description of CERCLA requirements and the Interagency Agreement (IAG) process through which identified areas of contamination are to be remediated. The GPMPP does not, but should, address the identification of new release sites. These "new" release sites, whether from a previously unidentified release or from a release that recently occurred, are described in the Historical Release Report (HRR) quarterly updates. From these updates the Agencies determine whether the release constitutes an Individual Hazardous Substance Site (IHSS). A new IHSS is eventually added to either an existing Operable Unit (OU), or a new OU could be created to address characterization and possible remediation of the IHSS.
- 7 Decontamination and decommissioning (D&D), and other remedial programs contained in DOE directives. The GPMPP does not describe groundwater monitoring or protection programs that will be developed to support building D&D. Because RFP is not actively involved in building D&D at this time, this omission is not considered a deficiency. Future versions of the GPMPP should include plans for coordinating groundwater monitoring activities associated with D&D. Many of the groundwater issues related to D&D will be addressed in the Industrial Area Interim Measures/Interim Remedial Action (IA IM/IRA). Future GPMPP revisions should incorporate the monitoring approach recommended in IA IM/IRA.

## **GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

### **I. CRITERIA**

2. The Plan incorporates procedural requirements to conduct annual reviews and to update the Plan and program every three years, or more frequently if needed

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Final Groundwater Protection and Monitoring Program Plan* (EG&G, 1991b)

*Draft Groundwater Protection and Monitoring Program Plan* (EG&G, 1992b)

*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)

Interview with Manager, Groundwater Program, Geosciences Division, EG&G

#### **Discussion:**

Compliance with this criteria requires not only a statement in the GPMPP that annual reviews and triennial updates will occur but documentation and procedures to ensure that these reviews take place and that updates are adequately communicated to relevant personnel

### **IV. FINDINGS**

Chapter 10 of the GPMPP clearly states that "this document will be reviewed annually with updated pages or sections issued to the appropriate recipients. Every three years, GPMPP will be revised to incorporate all updates." Thus, the basic requirement of planned reviews and updates is fulfilled. A description of the procedures in place to ensure that these updates occur is, however, not discussed within the GPMPP.

The GPMPP has been reviewed internally on an annual basis and has received public comment at least once. The first final GPMPP, issued on November 27, 1991, was reviewed and substantially updated with a subsequent version dated November 25, 1992. This document was in turn updated and reissued on October 15, 1993.

The updates are adequately communicated to relevant personnel. As a document prepared to comply with a DOE order, the Geosciences Division transmits GPMPP updates to DOE, the involved regulatory agencies (the U.S. Environmental Protection Agency and the Colorado Department of Health) and RFP public reading rooms. The document is not intended to provide implementing instructions for any specific programs and, therefore, is not widely distributed to EG&G personnel.

## **GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

### **I. CRITERIA**

3. The Plan includes a description of the hydrogeologic setting for the site, summaries of prior investigations, and plans for future studies.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Protection and Monitoring Program Plan (EG&G, 1993e)*

#### **Discussion:**

This criteria only requires that a complete discussion of these topics exist in the GPMPP. The adequacy and accuracy of RFP's understanding regarding the hydrologic setting for the site is more fully assessed under Criteria 16 through 20 and 27. The discussion of the hydrogeologic setting in the GPMPP should be consistent with the recommendations and findings made under these criteria.

### **IV. FINDINGS**

The GPMPP complies with this criteria in that it includes a description of the hydrogeologic setting, references to other hydrogeologic characterization documents, summaries of past and on-going groundwater monitoring investigations and plans for future investigations.

The GPMPP does not summarize the groundwater monitoring activities and results at all Operable Units (OUs) but only selected higher priority sites. For those OUs discussed, the level of detail provided in the GPMPP is variable. For example, the GPMPP provides a much more detailed discussion of groundwater results at the Solar Ponds (OU 4) than at OU 1 or OU 2. Lastly, the information regarding groundwater quality at OU 1 and OU 2 is outdated (based on 1989 data) and should be updated. In addition, summaries of more recent investigations, such as those at OU 5 and OU 6, should be included.

Plans for future investigations were often couched in terms of proposed studies contingent on obtaining funding, thereby making a definitive understanding of the scope and schedule of future studies difficult.

# GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM

## I CRITERIA

4. All elements of the Groundwater Protection and Monitoring Program (GPMoP) have been identified, and responsibilities for each element have been defined by organizational unit, or individual position. Such elements include well installation, health and safety, sampling and analysis, data evaluation and reporting, and quality assurance. Organization charts showing clear lines of authority have been prepared.

## II. PRIMARY REGULATORY DRIVER

DOE Order 5400 1

## III. BASIS OF OPINION

### Documents Reviewed and Personnel Interviewed:

*Groundwater Protection and Monitoring Program Plan (EG&G, 1993e)*

### Discussion:

None

## IV. FINDINGS

Compliance with this criteria is not documented within the GPMPP. Although the GPMPP discusses programs designed to meet all important elements of the GPMoP required by DOE Order 5400 1, it does not contain information on organizational unit or position responsibilities. Thus, an individual reading the GPMPP is not given information needed to know which organizational unit has direct responsibility for each program element.

## **GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

### **I. CRITERIA**

5. All pertinent documents, such as hydrogeological characterization studies, sampling plans, analytical methods, quality assurance documents and SOPs have been referenced.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)

#### **Discussion:**

None

### **IV. FINDINGS**

The GPMPP has an extensive reference list, and while most major documents are referenced, not every document known to be relevant is listed. For example, there is a lack of documents published in 1993. Because the GPMPP is published in the last quarter of the year, relevant documents published in the first two quarters of the year should be referenced. Some site-specific documents are not included, such as the 1992 and 1993 *Annual RCRA Groundwater Monitoring Reports*, the vadose zone characterization work at the sludge drying beds, reports being conducted in the OU 2 area, and *Technical Memorandum No. 1* for the Phase I Remedial Investigation/RCRA Facility Investigation.

# GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM

## I. CRITERIA

6. The existing well network has been described, and details of construction and abandonment are referenced.

## II. PRIMARY REGULATORY DRIVER

DOE Order 5400 1

## III. BASIS OF OPINION

### Documents Reviewed and Personnel Interviewed:

*Permitting of Monitoring Wells at the Rocky Flats Plant* (Wright Water Engineers, Inc , 1993a)

*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)

### Discussion:

None

## IV. FINDINGS

The current monitoring network is adequately described in most respects and the well construction and abandonment details are adequately referenced. However, the discussion in the GPMPP does not completely conform with the 1993 report entitled, *Permitting of Monitoring Wells at the Rocky Flats Plant* (Wright Water Engineers, Inc , 1993). For example, the GPMPP states that 56 monitoring wells were installed between 1960 and 1982, whereas tables in the well permitting report show 84 wells drilled during this time period. Similarly, in 1986 the GPMPP discusses 70 well installations, whereas the well permitting report shows 71. Lastly, the GPMPP does not discuss the piezometers installed in 1988 as part of the electric utility upgrade. The relevant well abandonment and replacement documents are not referenced in the GPMPP, although the program is discussed.

In general, the GPMPP does not reflect the level of uncertainty associated with tracking the past installation of monitoring wells nor what mechanisms are currently employed to ensure that all wells are properly documented.

# **GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

## **I CRITERIA**

7. **The Groundwater Protection Management Program (GPMP) described in this Plan includes the Groundwater Monitoring Program (GMP) discussed in Performance Objective GW2. Although the GMP is not required to be fully in place until November 9, 1991, the monitoring program in existence by May 9, 1990 has been documented in the management program plan.**

## **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

## **III. BASIS OF OPINION**

### **Documents Reviewed and Personnel Interviewed:**

*Final Groundwater Protection and Monitoring Program Plan (EG&G, 1991b)*  
*Groundwater Protection and Monitoring Program Plan (EG&G, 1993e)*

### **Discussion:**

None

## **IV. FINDINGS**

Compliance with this criteria is well documented RFP came close to meeting the November 9, 1991 deadline through publication of the first final GPMPP on November 27, 1991 In addition, the most current GPMPP includes the required GMP

# **GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

## **I. CRITERIA**

8. Details of the design and implementation plan for any upgrading of the monitoring system required to meet the November 9, 1991 specifications are presented.

## **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

## **III. BASIS OF OPINION**

### **Documents Reviewed and Personnel Interviewed:**

*Final Groundwater Protection and Monitoring Program Plan (EG&G, 1991b)*  
*Groundwater Protection and Monitoring Program Plan (EG&G, 1992b)*  
*Groundwater Protection and Monitoring Program Plan (EG&G, 1993e)*

### **Discussion:**

Since the November 9, 1991 deadline has passed, it is assumed that this criteria requires the GPMPP to detail plans for any future upgrades, not just those needed to meet the November 9, 1991 specifications

## **IV. FINDINGS**

Compliance with this criteria is well documented. Each version of the GPMPP contains a section (Chapter 6) regarding recommendations for monitoring network improvements. In some instances it is difficult to know whether improvements discussed in Chapter 6 of each GPMPP have indeed been implemented because no schedule is provided. It is recommended that updates of the GPMPP discuss the disposition of previous year's recommendations.

# **GW1 GROUNDWATER PROTECTION MANAGEMENT PROGRAM**

## **I. CRITERIA**

9. Formal, written procedures are in place to ensure that all facility operations, including planning and construction of new production facilities, closure of existing waste management units, design, construction and operation of new waste management units, and decontamination and decommissioning of facilities contaminated with radioactive materials are coordinated with, and consistent with, the *Groundwater Protection and Monitoring Program Plan* (GPMPP).

## **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

## **III. BASIS OF OPINION**

### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Protection and Monitoring Program Plan*, (EG&G, 1993e)  
Memorandum from DOE to EG&G re Control of Groundwater Well Installation (DOE, 1993b)

Memorandum from EG&G to DOE re Well Control Program Proposal (EG&G, 1993f)

Memorandum from DOE to EG&G re Groundwater Well Control Program (DOE, 1993c)

*EMD Operating Procedures, Manual No 5-21000-OPS-GT, Volume III - Geotechnical* (EG&G, 1993c)

*Conduct of Engineering Manual* (EG&G, no date)

*Environmental Management Requirements Manual* (EG&G, no date a)

*Integrated Work Control Program Manual* (EG&G, no date b)

Interview with Manager, Industrial Area IM/IRA, EG&G

Interview with Senior Hydrogeologist, EG&G

Interview with Managers, Operable Unit (OU) 3, 5 and 6, EG&G

Interview with Manager, Groundwater Program, Geosciences Division, EG&G

Interview with Supervisor, Operations Technical Support, EG&G

Interview with Technical Administrator, Geosciences Division, EG&G

Interview with Senior Hydrogeologist, Geosciences Division, EG&G

Interview with Director, Well Abandonment and Replacement Program, EG&G

**Discussion:**

Compliance with this criteria was assumed to require that personnel responsible for the Groundwater Protection Program within the Geosciences Division of Environmental Restoration and Management (ERM) be assigned to the specific task of tracking facility operations, including both radioactive and non-radioactive operations. This responsibility must be formalized in procedures and policies that are recognized by all other divisions and programs within RFP.

**IV. FINDINGS**

Compliance with this criteria is largely undocumented and undemonstrated. RFP does have programs or planned programs that partially fulfill the intent of this criteria but to date RFP does not have personnel dedicated to ensuring *all* facility operations are coordinated with the GPMPP.

Policies which are to be implemented on a sitewide basis are documented by EG&G in high-level policy manuals such as the *Plant Policy Manual*, *Quality Assurance Manual*, *Conduct of Engineering Manual* and the *Integrated Work Control Package (IWCP) Manual*. According to the Geosciences Division Administrative Assistant, most high-level policy documents do not contain specific language requiring consistency with the GPMPP. Instead they contain broad goals and mission statements to ensure that plant activities are conducted in an environmentally responsible way, and reference lower-level SOPs for specific detailed instructions. For example, the *Conduct of Engineering Manual* requires all engineering functions to "conduct professional activities ethically with the highest regard for safety, security and the environment." Although this language could be interpreted to require consideration of groundwater protection, the lower-level engineering SOPs contain no requirements for coordinating activities with the GPMPP. There are currently no engineering procedures in place to ensure that groundwater protection and groundwater monitoring activities are considered during the design phase of projects, and that groundwater personnel have a chance to review design packages prior to the design being finalized.

The *IWCP Manual* requires facility operations to obtain a permit for all activities which will involve soil disturbance, including wells, as part of the IWCP process. Currently, ERM has an individual assigned to review these permits, however, no formal written policy requires the reviewer to incorporate Geosciences Division SOPs into permits for groundwater well installation or sampling.

According to the *IWCP Manual*, IWCPs are required for a variety of RFP projects but do not apply to routine operational activities which do not modify existing systems, structures, components or real estate (such as Remedial Investigation/Facility Studies). These operational activities are instead to be performed in accordance with procedures, work plans, site-specific Health and Safety plans, and Quality Assurance plans prepared

specifically for the work to be performed and approved by the appropriate authorities (such as the performing organization, Engineering, Health and Safety, and Quality Assurance) Therefore, even if ERM reviewed all IWCPs, this would not ensure that all facility activities are adequately tracked

Activities that do not involve soil disturbance or well installation, but that have the potential to impact groundwater (such as transfer of waste materials or import of new chemicals onto the site), are less likely to be tracked by ERM ERM currently has an individual assigned to review all IWCPs associated with activities in the buffer zone The review conducted does not, however, include an assessment of potential impacts to groundwater or the groundwater monitoring program, nor does anyone within ERM routinely review all IWCPs associated with the Industrial Area

D&D activities are similarly outside the scope of review by personnel responsible for groundwater protection This oversight has been noted by the Transition Standards Identification Program (TSIP), which recommends that procedures developed for conducting D&D activities should include a review for groundwater issues

The Geosciences Division has responsibility for consolidating hydrogeologic data into a central location and this responsibility is formally documented in the Geosciences Division Charter but not within any SOPs SOP GT 01 (well logging) requires a sign-off by a registered geologist who has also completed a specified training course Although this training course is administered by the Geosciences Division, it is not clearly defined in the SOP as a Geosciences Division responsibility It should also be noted that SOP GT 07 (logging of test pits, etc ) does not have a sign-off requirement similar to that in SOP GT 01, thus it is unknown whether proper soil profile records are being kept

The Geosciences Division, in response to a request from DOE, is developing a well control program that ensures that, on a site-wide basis, well installation is coordinated through Geosciences The goals of the program are to ensure that each new well serves a justifiable need, has plans for future use and abandonment, is properly documented and permitted and that environmental protection is considered during the construction or abandonment Once in place, this policy will ensure that all well installation is consistent with the GPMPP It will not, however, necessarily require all sampling activities to be performed in compliance with Geosciences-approved SOPs

In conclusion, the Geosciences Division currently has in place a mechanism to track activities involving soil disturbance and will soon have an approval mechanism over all groundwater well installations Other plant activities that could impact groundwater are not monitored by the Geosciences Division and are not required by current high-level policy documents and specific SOPs to be consistent with the GPMPP

## **GW2 GROUNDWATER MONITORING PROGRAM**

### **OBJECTIVE REQUIREMENT**

A groundwater monitoring program should be implemented to monitor groundwater both on-site and in the vicinity of the facility

DOE 5400 1, General Environmental Protection Program, Chapter IV, Section 9 b lists specific requirements for a Groundwater Monitoring Program

DOE 5400 1, Chapter II, Section 4 requires that the environmental data from the Groundwater Monitoring Program be represented in the Annual Site Environmental Report

DOE 5400 1, Chapter IV, Section 1 b requires that the Groundwater Monitoring Program be developed and implemented by November 9, 1991

### **I. CRITERIA**

10. The groundwater monitoring program has been documented in a Groundwater Monitoring Program (GMP). The GMP is a specific element of the Environmental Monitoring Plan required by DOE Order 5400.1, Chapter IV, Section 4.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Protection and Monitoring Program Plan (EG&G, 1993e)*

**Discussion:**

Compliance with this criteria requires that a GMP be in place and address the elements of DOE Order 5400 1, Chapter VI, Section 4. Section 4 requires that the monitoring plan contain the rationale and design criteria for the monitoring program, extent and frequency of monitoring and measurements, procedures for laboratory analyses, quality assurance requirements, program implementation procedures, and direction for the preparation and disposition of reports.

**IV. FINDINGS**

RFP has chosen to incorporate the Groundwater Monitoring Program (GMP) into the GPMPP and this is clearly stated in the Introduction. The specifications of DOE Order 5400 1, Chapter IV, Section 4 are largely met, with some exceptions. Each element is discussed separately below.

- 1 **Rationale and design criteria for the monitoring program** Although no separate section is dedicated to this topic, the introductory sections and Section 4.3 of the GPMPP adequately describe the regulatory and technical rationale behind the monitoring program.
- 2 **Extent and frequency of monitoring and measurements** Section 1.4.4 and Section 4.3 adequately discuss the number of wells sampled and the frequency of water level and water quality measurements.
- 3 **Procedures for laboratory analyses** This requirement is adequately summarized in Section 4.3, and the appropriate documents are referenced.
- 4 **Quality assurance requirements** The quality assurance procedures employed for the entire groundwater monitoring program for the GPMPP are referenced but not described in Section 4.3.3.
- 5 **Program implementation procedures** While not covered in a specific, dedicated section, the procedures for implementing the groundwater monitoring program are adequately discussed throughout the GPMPP although the GPMPP itself is not an implementation document.

- 6     Direction for the preparation and disposition of reports     Section 1 3 2 of the GPMPP provides an excellent list of historical reports containing groundwater related information. However, discussion regarding the location and accessibility of these reports is lacking, as is a discussion on availability of reports to be generated under the sitewide monitoring program. For example, little detail is provided on how the monthly and quarterly water-level data are compiled and summarized, or how and when the sitewide groundwater quality investigation discussed in Section 6 3 will be documented. Furthermore, no requirements exist to assure that the recommendations made in reports are considered, addressed or implemented.

## GW2 GROUNDWATER MONITORING PROGRAM

### I. CRITERIA

11. The Groundwater Monitoring Program (GMP) identifies all DOE requirements and federal, state and local regulations applicable to groundwater protection, explains the site-specific monitoring strategy in use, and specifies all elements of the GMP. The rationale or purpose for selecting these elements is explained.

### II. PRIMARY REGULATORY DRIVERS

DOE 5400 1  
DOE Order 5400 3  
DOE Order 5400 4  
RCRA  
Colorado Hazardous Waste Act  
CERCLA  
Clean Water Act  
Safe Drinking Water Act  
Colorado Water Quality Control Act  
Agreement in Principle  
IAG  
State Engineer's Office

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*Groundwater Protection and Monitoring Program Plan (EG&G, 1993e)*

#### Discussion:

It is assumed that compliance with this criteria requires a separate evaluation of the three subparts. It is also assumed that the criteria requires an explanation of the site-specific monitoring strategy in use to ensure compliance with the pertinent regulations identified. Lastly, it is assumed that the phrase "all elements of the groundwater monitoring program" refers to those elements specified in DOE Order 5400 1, Chapter 4, Section 9 (Groundwater Monitoring Program). These elements are a "sampling plan, sampling, analysis and data management."

#### IV. FINDINGS

The details of each subpart to the criteria are discussed below

- 1 Identification of all DOE requirements and federal, state and local regulations applicable to groundwater protection Section 3.3 of the GPMPP lists and discusses regulatory requirements pertinent to groundwater monitoring and protection. Although substantially complete, minor deficiencies in the discussion are as follows
  - DOE Orders 5482.1 and 5484.1 are listed as relevant but are not described. DOE Order 5482.1B entitled "Environment, Safety, and Health Appraisal Program" and DOE Order 5484.1 entitled "Environmental Protection, Safety, and Health Protection Information Reporting Requirements" should be reissued to determine if they contain specific or unique groundwater monitoring and reporting requirements.
  - The Water Quality Control Commission (WQCC) Site Specific Standards are found in Appendix B rather than Appendix D as listed in the text.
  - No discussion is provided for requirements imposed by the State Engineer's Office (SEO).
  - No discussion is provided of the groundwater protection requirements under RCRA Subtitle D, Part 257. Part 257 applies to solid waste disposal facilities and practices, such as landfills, that are not regulated under Subtitle C of RCRA and that are not municipal solid waste landfills (MSWLFs). Part 257 does not specifically require groundwater monitoring. It specifies, however, that "a facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or beyond an alternative boundary." 40 CFR § 257.3-4(a).
  - No discussion is provided of the SDWA. Because the SDWA is specifically covered in DOE Order 5400.1, the GPMPP should state that the groundwater protection requirements of the SDWA (the sole source aquifer protection, wellhead protection and underground injection control) are not relevant to RFP.
  - The GPMPP does not discuss the State Discharge Permit System to Groundwater of 5 CCR 1002-8 which became effective July 1, 1993. This regulation sets limits on surface discharges to groundwater, and requires

activities such as use of unlined impoundments for water treatment. The need for groundwater monitoring at the A-, B- and C-series ponds is subject to regulatory interpretation and may be required in the future.

- 2 Explain the site-specific monitoring strategy in use. Compliance with this requirement is partially documented in Chapter 5.0 of the GPMPP. There is not a one-to-one correspondence between the regulatory requirements of Chapter 3.0 and the list of programmatic responses in Chapter 5.0. For example, the following inconsistencies/omissions were noted:
  - The GPMPP only discusses how the objectives of DOE Order 5400.1 are met and not other DOE orders listed in Chapter 3.0.
  - Three of the eight recommendations by the Governor's Rocky Flats Scientific Panel on Monitoring Systems were not addressed in Chapter 5.0. Those recommendations not discussed were to identify and document information objectives for the monitoring program, to implement state-of-the-art technologies and to implement use of a mobile sampling van.
  - The recommendation from the Rocky Flats Environmental Monitoring Council to ensure full financial and other commitments to meet health and safety and environmental goals regardless of protection needs or other factors was not addressed in Chapter 5.0.
- 3 Specifications and rationale for all elements of the groundwater monitoring program. Information regarding the sampling plan, and sampling and analysis, is summarized adequately within the GPMPP and appropriate references for more detailed discussions are provided. Details regarding data management are inadequately referenced within the GPMPP. The GPMPP does not clearly state that details regarding data management are included in the General Radiochemistry and Routine Analytical Services Protocol (GRRASP).

## **GW2 GROUNDWATER MONITORING PROGRAM**

### **I. CRITERIA**

12. A sampling and analysis plan provides details on all elements of the Groundwater Monitoring Program (GMP) that are referenced, rather than fully described, in the GMP.

### **II. PRIMARY REGULATORY DRIVERS**

DOE Order 5400 1  
DOE Order 5700 6C  
RCRA  
Colorado Hazardous Waste Act  
IAG  
SOPs

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Persons Interviewed:**

*EMD Operating Procedures, Manual 5-21000-OPS-FO, Vol I, Field Operations (EG&G, 1993a)*

*EMD Operating Procedures, Manual 5-21000-OPS-GW, Vol II, Groundwater (EG&G, 1993b)*

*General Radiochemistry and Routine Analytical Services Protocol, Parts A and B (EG&G, 1991b)*

Interview with Environmental Sample Tracker, EG&G

Interview with Manager, Sample Management Office, EG&G

Interview with Sample Management Office, EG&G

Interview with Project Manager, QuantaLex

Interview with Staff Consultant, QuantaLex

Interview with Oversight Manager, Field Services, EG&G

Interview with Procedure Development, SAIC

Interview with Project Manager, Woodward-Clyde

Interview with Site Supervisor, Woodward-Clyde

**Discussion:**

None

**IV. FINDINGS**

Although there are many detailed SOPs for sampling and analysis that are used by the sitewide GMP, no unified sampling and analysis plan specifically for the sitewide GMP exists

## GW2 GROUNDWATER MONITORING PROGRAM

### I. CRITERIA

13. Approved standard operating procedures are in place that provide step-by-step instructions for sampling and analysis. These procedures cover such aspects of the program as well purging, disposal of purge water, sample collection, sample preservation, sample documentation and analytical methods.

### II PRIMARY REGULATORY DRIVERS

DOE Order 5400 1  
DOE Order 5700 6C  
SOPs

### III. BASIS OF OPINION

#### Documents Reviewed and Persons Interviewed:

*RCRA Orientation Manual* (U S EPA, 1990)  
*RCRA Ground-water Monitoring Technical Enforcement Guidance Document* (U S EPA, 1986)  
*EMD Operating Procedures, Manual 5-21000-OPS-FO, Vol I, Field Operations* (EG&G, 1993a)  
*EMD Operating Procedures, Manual 5-21000-OPS-GW, Vol II, Groundwater* (EG&G, 1993b)  
*General Radiochemistry and Routine Analytical Services Protocol Parts A and B* (EG&G, 1991c)

Interview with Environmental Sample Tracker, EG&G  
Interview with Manager, Sample Management Office, EG&G  
Interviews with Sample Management Office Personnel, EG&G  
Interview with Project Manager, QuantaLex  
Interview with Staff Consultant, QuantaLex  
Interview with Field Supervisor, Field Services, EG&G  
Interview with Procedure Development, SAIC  
Interview with Project Manager, Woodward-Clyde  
Interview with Site Supervisor, Woodward-Clyde

**Discussion:**

Confirmation of compliance with this criteria is based on interviews and reviews of SOPs to verify their existence and appropriateness. Field verification of SOP implementation was beyond the scope of this assessment. However, in the course of interviews, when improvement comments were made regarding field practices and protocol, they were noted and were included in the text that follows.

**IV. FINDINGS****Present Program:****Field Sample Collection**

Environmental Management SOPs with step-by-step instructions that cover well purging, disposal of purge water, sample collection, sample preservation and sample documentation are located in the sampling contractors trailers. In general, the sampling program is well-designed and meets most of its objectives.

**Laboratory Sample Analysis**

SOPs required for analytical laboratory protocols are identified in the GRRASP Statement of Work document. GRRASP is divided into two parts. Part A deals with organics, inorganics, water quality parameters, biochemistry, and biota, Part B deals with radioisotopes. In general, the GRRASP document is very comprehensive and clearly requires step-by-step instructions (SOPs) be submitted by contract laboratories for every part of the analytical program including the quality assurance/quality control (QA/QC) program. The SOPs submitted by the contract laboratories are very detailed and are scrutinized by both EG&G and outside experts for adequacy.

The QA/QC program in place is thorough and well-designed, although several possibilities exist for improvement. The program has an elaborate system of internal and external checks that serve to call attention to most deviations from SOPs. An outside contract firm, QuantaLex audits all stages of work product from contract analytical labs. Their audit level is 100 percent, meaning that every report associated with every sample is examined. They also visit and evaluate laboratories prior to the granting of a contract for work and once a year after a contract has been awarded. As part of the contract awarding process, QuantaLex reviews the qualifications of all laboratory personnel in a pre-contract audit. They also confirm that senior laboratory staff properly supervise and sign-off on the work product of lower level employees. After a contract has been awarded, QuantaLex reviews the qualifications of personnel newly assigned to the RFP program.

To provide services to RFP, contract laboratories are required to demonstrate their participation and scores in EPA's performance evaluation program. Subcontractors are subject to announced and unannounced on-site inspections or audits. Contract laboratories that became deficient in their QA/QC practices have been dropped from the analytical program at RFP.

A very important aspect of the QA/QC program is that it is subject to continual assessment by the responsible personnel and is revised as deficiencies become apparent. Requiring frequent review and allowing for timely revisions is essential to such a complex program. A revised GRRASP document is nearing completion by QuantaLex. Thus, QA/QC protocol improves by evolution from an already strong program.

#### **Programmatic Issues of General Concern:**

##### **Field Sampling SOPs:**

###### **1 Concern**

Field SOPs do not always adequately describe the rationale behind the step-by-step procedures so that users know why they must be followed. This can result in "short-cuts." Some examples of short-cuts that could be taken are as follows:

- a Reducing the number of sample coolers to be shipped by decreasing the amount of absorbing and cushioning materials in the coolers in order to pack more samples into a single cooler
- b Emptying a sampling bailer from the bottom by opening the check valve with a gloved finger, potentially contaminating the sample
- c In properly filling out all the required forms associated with identifying samples and maintaining the proper chain-of-custody (COC) information
- d Carelessness in being certain that each sample bottle is tightly closed

###### **Recommendation**

Problems like these would be alleviated if SOPs contained an explanation of the purpose for the separate steps, and if these explanations were emphasized in training and were frequently reiterated by supervisory personnel.

2     Concern

Many SOPs contain a large number of Document Change Notices (DCNs) at their beginning without corresponding changes in the text of the document. This complicates the process of using an SOP and increases the potential for error.

Recommendation

The latest update of the SOPs reflects the use of Document Modification Requests (DMRs) which does update the subject SOP, however, specific SOPs with multiple DCNs at their beginning should be updated even if a current modification is not requested.

3     Concern

Some SOPs might be more restrictive than necessary and should be reviewed to simplify procedures when it does not compromise the validity of the sampling program. For example, at present all COC documentation must be completed at the sampling site before transport. This can become a burden when many forms are required and inclement weather prevails, leading to hurried and error-prone compliance with the SOP.

Recommendation

Comments by users of SOPs should be solicited and reviewed, in order to improve procedures. The COC documentation procedure should be reviewed to determine the feasibility of allowing sampling teams to fill out some COC forms at a central location, whenever such a procedure improves the validity of the sampling program.

4     Concern

There are currently as many as four COC forms per well that must be filled out.

Recommendation

A consolidation of some laboratory forms, where possible, would reduce paper work, and minimize the possibility of transcription errors.

5 Concern

At present, radiological screening is required for all wells in the groundwater monitoring program prior to sampling. Wells must be sampled within 3 days after radiological screening samples are collected (Rev SOP GW 6 Sec 5 8 3). This time period is inadequate under certain circumstances, such as for slowly recharging wells and under severe weather conditions.

Recommendation

The technical basis for the present 3-day time window for sampling after radionuclide (RAD) screening should be reviewed, and uncontrollable factors that can increase the required time allowed for sampling should be taken into consideration.

6 Concern

SOPs dealing with field instrument calibration generally require that more frequent calibrations be made when the instrument indicates signs of poor stability or impending failure. This approach will not address problems due to the use of instruments which cannot meet their specifications because of component deterioration. If the instrument requires more frequent calibration than normal, readings could be in error.

Recommendation

Where appropriate, SOPs should specify the need for abandonment or repair of some instruments or sending them back to the manufacturer for repair. In general, calibration procedures should follow the recommendations of the manufacturer.

7 Concern

It sometimes happens that, at a particular well, required water level measurements are made too soon after sampling and the well may not have fully recovered.

Recommendation

Water level measurements should be coordinated with the sampling program and should be included in the water level measurement SOP. The well sampling schedule should always be checked by the water level measuring team, which

should have the discretion to reschedule their measurements to ensure accurate results

8 Concern

There is no master index to all SOP and guidance documents relevant to the groundwater monitoring program. It is very difficult to determine which documents are pertinent and which take precedence in the event of inconsistency.

Recommendation

A master index is desirable that will identify all the main documents required in the groundwater monitoring program, in order of hierarchy. The index should identify all the main subjects discussed in each document and where the documents are located.

9 Concern

SOPs do not address every situation that may arise in the groundwater monitoring program. For example, SOPs for sampling do not specifically require that sample container closures be checked for tightness after filling.

Recommendation

A general statement should be placed in every SOP that directs SOP users to rely on current industry standard practices when no specific instruction exists in the SOP. This averts any assertion that procedures not specifically listed by the SOP are of no concern.

10 Concern

SOP FO 3 does not follow RCRA *Technical Enforcement Guidance Document* (TEGD) protocol with regard to decontamination procedures. RCRA requires the use of acids and organic solvents while the SOP allows the use of water and non-phosphate detergents only. The procedure followed by field teams is that of the SOP, and is regarded by the authors of this document to generally be more preferable because it adequately decontaminates the equipment while avoiding potential for hexane contamination.

Recommendation

A rationale should be presented in the SOP with regard to deviations from the TEGD

11 Concern

Contaminants may be encountered at RFP that could cause purge water to be classified as hazardous waste (per SOP 5-21000-OPS, FO 5) Under the IAG, RFP must comply with RCRA requirements, including holding times, for investigation-derived waste *RCRA Orientation Manual 1990 Edition*, Chapter II, pg III-20, "Accumulation of Waste," states that the maximum hazardous waste hold time is 90 days after receipt of sample characterization, but this time limit is not mentioned in SOP FO 5 The applicability of this time limit is being discussed within EG&G and among the regulatory agencies

Recommendation

Depending on the findings of the current task team, the RCRA-required 90-day holding time limit should be included in SOP FO 5 for the handling of purge and development water

12 Concern

There is no formal requirement that pertinent DMRs be reviewed by the Groundwater Division

Recommendation

Technical review and approval by the Groundwater Division should be required for pertinent DMRs

Analytical Procedures and GRRASP:13 Concern

The most general criticism of the overall validation program might be that it is too thorough, becoming in some parts redundant rather than self-correcting The very high degree of independent review that is a part of every stage of sample analysis

and data collection seems excessive, even in light of the close regulatory observation received by RFP. As a point of illustration, QuantaLex performs a 100 percent validation of all laboratory data, despite the fact that data reduction is mostly computer automated once the analytical instrument is calibrated and the sample has been introduced into the instrument. In addition, validation of computer output cannot detect errors in sample preparation.

#### Recommendation

A simpler approach that would probably be less costly and at least equally effective, would be to rank laboratories by competence and validate a significantly smaller amount of the data from highly ranked laboratories. Ranking could be on a basis of performance with known standard samples included as "blinds" with the regular field samples. It is a similar idea to EPA's performance evaluation program, but has the advantage that the laboratory does not know which samples are the "blinds." In the EPA program, laboratories have the opportunity to make their very best effort, which might not be typical of their routine performance. Laboratory Control Samples, required of all laboratories in the RFP QA/QC program, serve a somewhat similar function, but also do not insure that all samples are treated alike. If RFP had its own performance evaluation program, by including one or two known "blinds" in each sample delivery group (SDG), laboratory performance with contaminant matrices that are characteristic of RFP samples would be tested at every stage of the data generating process. The cost of operating an RFP performance evaluation program should be offset by the reduction in the required level of data validation. Under the IAG, such a change in the validation program would require approval by EPA and CDH.

#### 14 Concern

Procedures maximizing laboratory efficiency and those which maximize sample collection efficiency are often in direct opposition. At present, there is no effort to optimize scheduling of the overall sample collection and analysis program. Laboratories are directed to follow the EPA-CLP definition of an SDG, which is 20 samples or all samples received within 14 days, whichever occurs first. In many cases, laboratory procedures cannot be optimized because the resulting SDG consists of many different kinds of samples in different matrices.

Laboratory efficiency is maximized when an SDG consists of similar types of samples, so that preparation procedures and QA controls are the same for a large group of samples. When a laboratory has to use different preparation procedures and calibrate with different standards for just a few samples, their costs increase considerably. Laboratories benefit from homogeneous SDGs, such as all samples

in a water matrix to be analyzed for volatile organics. The advantages of optimizing laboratory practices are shorter turn-around times and possibly better accuracy and lower costs.

#### Recommendation

The trade-offs between the most efficient sample collection operations and efficient lab procedures should be examined closely, and manipulated for RFP's benefit. At present, SDGs are not often assembled with regard for optimal laboratory procedures. Whether or not a central sample collection point is implemented in the near future, consideration should be given to the advantages of trying to establish better coordination among the different sampling programs in order to allow more uniform SDGs to be sent to laboratories.

#### Specific Comments:

A number of SOPs containing erroneous or confusing procedures need to be reviewed and corrected as follows:

#### **Field Sampling SOPs**

##### 1 Concern

Form GW 1A, Groundwater Levels, Measurements and Calculations contains fields to be filled out when following SOP GW 06, Sec 5.6, Well Purging. However, this SOP makes no reference to the form.

#### Recommendation

The form should be referenced in SOP GW 06, Sec 5.6, Well Purging.

##### 2 Concern

SOP GW 06, Sec 5.6.2, Purging Methods requires that the rate of water withdrawal during purging never exceed the rate at which the well was developed. The purpose of this requirement is to insure that the well water composition is representative of the formation water.

Recommendation

The requirement is unrealistic because the rate of well development usually is not documented. The purging rate should be specified in terms of not allowing well infiltration to cascade down the side of the well screen. For low yielding wells, purging should be at a rate that does not cause recharge water to be excessively agitated.

3 Concern

There is a discrepancy in the SOPs regarding the recovery of a well to determine if the well is "purged dry" (GW 06, 5 6 1,(2)). The SOP indicates that a well is dewatered when the static water level requires more than thirty minutes to recover 90 percent of its original level. It also states that, for wells screened at a specific interval below the static water level, the criteria of 90 percent recovery in less than 30 minutes applies only to the screened interval plus 2 feet.

Form GW 06B also provides a set of calculations to determine if the well is a dry well. These two requirements are confusing for two reasons: (1) The SD number is calculated by subtracting 2 feet from the depth to screened interval rather than adding 2 feet to the screened interval as stated in the text, and (2) the question following the SD formula asks if Water Depth (WD) is less than (SD-2) feet. This appears to be misstated because (-2) feet is already factored into SD. Subtracting another 2 feet would equal 4 feet above the screened interval. The equations associated with Form GW 06B are difficult to follow, which leads to potential errors.

Recommendation

This entire discussion/calculation should be reviewed and clarified. There is confusion about the correct interpretation of these equations.

4 Concern

Text in Section GW 6, 5 6 1,(1) should be clarified regarding the measurement of field parameters. The text states, "At least three casing volumes of water are removed from the well, and the last three consecutive pH, specific conductance, and temperature measurements deviate by less than 10 percent."

Recommendation

This should be rephrased to state that, "none of the last three measurements for each respective parameter is allowed to deviate by more than 10 percent "

5 Concern

Most of the wells installed at the RFP site have a sediment sump. These sumps may contain water even though the static groundwater level is below the bottom of the well screen.

Recommendation

When the water level is at or below the bottom of the screen, the well should be classified as "dry". Sampling and water level measurements should not be attempted because the sump water may not be representative of formation water level or quality.

6 Concern

There is a procedure for abandoning wells that are known to have been dry for more than two years. However, many wells that fulfill the abandonment requirements are still being monitored for water level.

Recommendation

The status of these wells should be reviewed and they should be removed from the water level monitoring program as appropriate. Such wells could be placed on inactive status or abandoned.

7 Concern

There currently is no QA testing of decontamination water stored in tanks on the sampling trucks before it is used for rinsing equipment.

Recommendation

An additional QA blank should be collected for testing the decontamination water before using it to rinse equipment.

8 Concern

No requirement exists to use COC seals on sample bottles

Recommendation

COC seals should be used on all sample bottles immediately after sample collection

9 Concern

The procedure in the RCRA TEGD for sampling low yielding wells differs from that in SOP GW 06 Section 5.8. According to the RCRA TEGD, after initial purging to dryness, the first sample should be collected as soon as possible. The SOP states that the well must recover 50 percent prior to sampling. The TEGD also states that samples should then be collected in the order of decreasing volatilization sensitivity of the parameters to be measured. The SOP allows the sampling order to be determined at the discretion of the sampling team.

Recommendation

The SOP should either follow or describe and give a rationale for its deviations from the TEGD.

10 Concern

The last sentence on page 29 of SOP GW 6 reads "one-liter bottles will have 5 mL of sample added prior to sample collection, while four-liter bottles may have up to 20 mL of acid."

Recommendation

This sentence should read " five mL of *acid* added prior to sample collection ", rather than 5 mL of *sample*

## Analytical Procedures and GRRASP

Although the overall QA/QC program is well designed and implemented, some details in the GRRASP documents were found that merit question or criticism. Some of the issues raised in these specific comments may be resolved in the forthcoming revision of GRRASP.

### Part A General Analytical Services Protocol (GASP)

#### 1 Concern *Part A*

On page 10, Section 5.1, background radioactivity at RFP is expressed in units of "Mr/Hour". A comparable paragraph in Part B (Part B, page 5, Section 5.1) gives the same background value in units of "mR/Hour". Neither set of unit symbols corresponds to standard usage.

#### Recommendation

Upper and lower case is very important in unit abbreviations ( $m = 10^{-3}$  and  $M = 10^6$ ). Secondly, capital "R" stands for Roentgen, which is an infrequently used unit for radiation exposure, expressed in terms of ionization produced in air by X-rays. This is an unlikely and generally unfamiliar unit in this context and should not be used, even if Roentgen was intended.

One might assume that the units intended are probably either "millirads per hour" (written as "mrad/hr") or millirems per hour (written as "mrem/hr"), but then the numerical value for background of 18 mrad/hr or 18 mrem/hr is far too high. The DOE radiation protection standard for the allowable effective dose equivalent from all pathways is 100 millirem per year (100 mrem/yr). Rads will be equal to or less than rems, depending on the nature of the radiation.

It seems likely that typographical errors have been propagated without being caught and that the intended background value is either 18 mrad/yr or 18 mrem/yr. However, all other radiation quantities in the document are expressed in picoCuries (pCi), which are the only units convenient for a rapid prescreening process. It would be best for a background count rate in pCi's to be used for expressing a background value. Background radiation is a critical quantity and should be expressed correctly and in a usable form.

2 Concern

The document does not contain a glossary of terms and acronyms

Recommendation

A glossary would be useful

Part B Radioanalytical Services Protocol (RASP)

3 Concern

On page 1, Section 1.2, it is indicated that  $^{238}\text{Pu}$  is only measured in air samples. Tables 1 and 2 on pages 10 and 11 confirm this.

Recommendation

What is the reason for not measuring  $^{238}\text{Pu}$  in soils and water? The decision should be justified somewhere.

Air measurements alone of  $^{238}\text{Pu}$  will not reveal the source area. Although the mass concentrations of  $^{238}\text{Pu}$  are probably much smaller than  $^{239/240}\text{Pu}$ , its specific activity is much higher. At Los Alamos National Laboratory, where all three plutonium isotopes are routinely analyzed in soil and water samples, the  $^{238}\text{Pu}$  activity in soil and water is typically very comparable with that of  $^{239/240}\text{Pu}$ .

4 Concern

On page 4, it is stated that attendance at periodic technical workshops may be required of participating laboratory personnel. We understand that only one or two such workshops have been held since the program began.

Recommendation

If such workshops are deemed valuable, perhaps a better defined schedule should be developed.

5

ConcernPart B  
B ✓

On page 5, Section 5.1, background radioactivity at RFP is expressed in units of "mR/Hour". A comparable paragraph in Part A (Part A, page 10, Section 5.1) gives the same background value in units of "Mr/Hour". Neither set of unit symbols corresponds to standard usage and neither is included in the Glossary of Part B.

Recommendation

See Comment 2 in *Specific Comments on Part A* above, for further discussion of this matter.

6

Concern

Page 9, Item 12 specifies the 16th edition of *Standard Methods* as a suitable source for non-CLP methods.

Recommendation

It is not wise to specify a particular edition because it will quickly be superseded. The "most recent edition" would be a better specification. The current "most recent edition" of *Standard Methods* is the 18th.

7

Concern

The Glossary, beginning on page 17, does not include any radiation dose units (rads and rems). Also, many acronyms used in the text are not in the glossary (e.g., RDL, SDG, SOP, MDA, CRDL, RFP, FOM, BKG, etc.).

Recommendation

A more complete glossary would be helpful.

## **GW2 GROUNDWATER MONITORING PROGRAM**

### **I. CRITERIA**

14. Training of the sampling teams and laboratory analysts has been documented.

### **II. PRIMARY REGULATORY DRIVERS**

DOE Order 5400 1  
DOE Order 5700 6C  
SOPs

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Persons Interviewed:**

*General Radiochemistry and Routine Analytical Services Protocol* Parts A and B (EG&G, 1991a)

Interviews with Sample Management Office Personnel, EG&G  
Interview with Project Manager, QuantaLex  
Interview with Staff Consultant, QuantaLex  
Interview with Oversight Manager, Field Services, EG&G  
Interview with Procedure Development, SAIC  
Interview with Project Manager, Woodward-Clyde  
Interview with Site Supervisor, Woodward-Clyde

#### **Discussion:**

Compliance with this criteria was evaluated through a review of training documentation and interviews to verify that training procedures have been implemented

### **IV. FINDINGS**

Field personnel are trained in the SOP procedures and records of non-radiation training received by individuals are also on-file in the trailers. Radiation worker training records are kept with the Field Office. The training programs are presented by EG&G and off-site experts. The performance of field teams is checked by EG&G oversight management.

As part of the contract awarding process, QuantaLex reviews the qualifications of all laboratory personnel in a pre-contract audit. They also confirm that senior laboratory staff properly supervise and sign-off on the work product of lower level employees. After a contract has been awarded, QuantaLex reviews the qualifications of personnel newly assigned to the EG&G program.

## GW2 GROUNDWATER MONITORING PROGRAM

### I CRITERIA

15. If RCRA-regulated units exist on site, applicability of and compliance with RCRA groundwater monitoring requirements are fully documented.

### II. PRIMARY REGULATORY DRIVERS

DOE Order 5400 1  
DOE Order 5400 3  
RCRA  
Colorado Hazardous Waste Act  
IAG  
SOPs

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*1990 Annual RCRA Groundwater Monitoring Report for Regulated Units at Rocky Flats Plant (EG&G, 1991)*  
*1991 Annual RCRA Groundwater Monitoring Report for Regulated Units at the Rocky Flats Plant (EG&G, 1992)*  
*Colorado Hazardous Waste Regulations (CDH, 1992)*  
*1992 Annual RCRA Groundwater Monitoring Report for Regulated Units at the Rocky Flats Plant (Addendum) (EG&G, 1993)*  
*"Final Technical Memorandum No 8" Revised Phase II RFI/RI Work Plan-OU 2 (DOE, 1993a)*  
*RCRA Groundwater Monitoring Technical Enforcement Guidance Document (U S EPA, 1986)*  
*Groundwater Program Compliance Report (Wright Water Engineers, Inc , 1993)*  
*Compliance Order No 89-06-07-01 (CDH, 1989)*  
*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (U S EPA, 1989)*  
*Final Ground-Water Assessment Plan (DOE, 1993)*

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**Discussion:**

In general terms, RCRA regulations can be divided into two broad categories of requirements for facilities at which RCRA is applicable. These two broad categories are interim status requirements (40 CFR 265) and fully permitted requirements (40 CFR 264). A limited subset of the OUs at RFP are RCRA-regulated units and are subject to RCRA requirements. These are the Solar Ponds (OU 4), the present landfill (OU 7) and the West Spray Field (OU 11). As of December, 1993, only interim status requirements are applicable to the RCRA-regulated units. Compliance with this criteria is evaluated based on interim status requirements of Part 265 only. Corrective action requirements of Part 264 are not discussed under this criteria but under Criteria 27-30.

**IV. FINDINGS**

Interim-status groundwater monitoring requirements are detailed in 40CFR 265 Subpart F (40 CFR 265 90-265 94). These regulations require installation of an interim status monitoring system capable of determining the impact of the facility on the quality of groundwater in the uppermost aquifer underlying the facility (40 CFR 265 90). The interim status regulations specify that the GMP must, at all times, comply with the requirements of one of the following types of groundwater monitoring systems: (1) Detection Groundwater Monitoring System, (2) Groundwater Assessment Monitoring Program (GAMP), or (3) an Alternate Groundwater Monitoring System (AGMS).

In 1986, when RCRA became applicable at RFP, a GAMP was implemented at the Solar Ponds and an AGMS was implemented at the present landfill and the West Spray Field. Both of these interim status monitoring programs in place at RFP must meet certain general requirements, as discussed in the following text.

Requirements in 40 CFR 265 90(a) and 265 91 establish the minimum performance criteria applicable to all GMPs at interim status facilities, they include:

- 1 The GMP must be capable of determining the impact of the facility on the quality of groundwater in the uppermost aquifer underlying the facility.
- 2 The GMP system must be capable of yielding groundwater samples for analysis (40 CFR 265 91(a)).

- 3 The system must contain at least one well hydraulically upgradient from the limit of the waste management area. The number and location of upgradient wells must be sufficient to yield groundwater samples representative of background groundwater quality in the uppermost aquifer near the facility, and must not be affected by the facility (40 CFR 265.91(a)(1))
- 4 The system must contain at least three wells hydraulically downgradient at the limit of the waste management area. The number, location and depths must ensure that they immediately detect any statistically-significant amounts of hazardous waste or constituents that migrate from the facility to the uppermost aquifer (40 CFR 265.91(a)(2))
- 5 Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing must be screened or perforated, and packed with gravel or sand where necessary, to enable sample collection at depths where appropriate aquifer flow zones exist. The annular space must be sealed to prevent contamination of the samples and groundwater (40 CFR 265.91(c))
- 6 The elevation of the groundwater in each monitoring well must be determined each time a sample is obtained (40 CFR 265.92(e))

The RFP groundwater monitoring system at the regulated units minimally complies with RCRA regulations, although some aspects of the monitoring system should be upgraded to ensure continued compliance. These units have at least one upgradient well and at least three downgradient wells. The three downgradient wells are at, or very near, the RCRA-defined point of compliance. Annual reports concerning the groundwater monitoring at these sites are also being made, as are the evaluations that are to be a part of these annual reports.

The above requirements are the minimum requirements under RCRA, therefore, more extensive or involved activities may be required to ensure future compliance with the RCRA requirements. In some instances, monitoring results obtained from the RCRA groundwater monitoring systems at the regulated units may not meet the RCRA requirement to fully characterize the unit and to determine the impact of the facility on the uppermost aquifer.

A number of groundwater-related issues have been raised in CDH correspondence that have never been fully addressed. For instance, two continuing issues are the existence of contamination in upgradient wells and the existence of some "dry" wells in the monitoring program during some quarters of the year. Both of these issues are tied to the requirements of the regulations 40 CFR 265.91.

With respect to the contaminated upgradient wells, contamination has been noted in some of the wells upgradient of RCRA-regulated groundwater monitoring units (such as the solar ponds). Therefore, CDH believes that these wells do not fulfill the requirement to be "not affected by the facility." However, RFP believes that these wells fulfill the RCRA requirements since it is believed that the contamination in the wells is due to releases from a unit other than the RCRA-regulated units. These wells are still believed to be useful in identifying any incremental changes in groundwater quality due to the RCRA units.

With respect to some dry wells being present in RCRA groundwater monitoring programs, CDH believes that the presence of a well that is dry even some of the time does not meet the requirement of "yielding groundwater samples." On the other hand, RFP believes that these wells are needed in order to determine that a particular flow path does not always have groundwater present. Further, RFP believes that some of these wells that are dry at times are necessary to meet the further requirement of RCRA to "immediately detect any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate from the waste management area to the uppermost aquifer" (40 CFR 265.91(a)(2)).

These issues, although discussed in detail at a number of meetings with CDH, have never been definitively resolved to the satisfaction of CDH, nor have these issues been specifically addressed in any of the RCRA-related groundwater documentation. These issues could be cited again by CDH as an area of concern or non-compliance. An effort should be made to resolve these issues in writing with the CDH.

Given the complexity of the groundwater flow system, additional wells may be required at the RCRA point of compliance at some of the units. Evaluations for overall water table evaluations and speed of contaminant movement required in the annual RCRA reports may also be deficient, given the complexity of the groundwater flow system. In particular, these comments pertain to the inferred hydraulic connection of water-bearing units that may not in fact be hydraulically connected. These two points are discussed in more detail below.

The characterization of subsurface conditions at the RCRA units has been general and based on assumptions of homogenous subsurface conditions. This type of characterization probably leads to oversimplification of the true subsurface lithologic conditions. An example of this potential oversimplification is shown in "Technical Memorandum (TM) No. 8" for the *Phase II RFI/RI Work Plan, OU 2*, Figure 1-11. The east spray fields shown in Figure 1-11 indicate groundwater flow to the northeast. The flow is controlled by a paleochannel that directs flow below Pond B-5. The groundwater flow expected from this site would be to the southeast. A similar situation is shown at the 903 pad on this same figure.

Data available for OU4 leads personnel involved in site characterization activities to believe that paleochannels in the top of bedrock are also present at that OU. These paleochannels could be having a significant influence on the occurrence of alluvial groundwater and the migration of contaminants at that OU. It is believed that these paleochannels could play a major role in site characterization at all of the OUs at RFP. The subsurface characterization work at the RCRA regulated units (OU4, OU7, and OU11) has not reached the level of detail achieved at OU1 and OU2. Until the subsurface characterization activities at OU4, OU7, and OU11 address the issue of presence or absence of paleochannels and other preferential migration pathways, the possibility exists that the RCRA groundwater monitoring programs at these OUs may be significantly deficient.

In addition to the above concerns, it should also be noted that relatively few site characterization activities have addressed groundwater movement in weathered bedrock materials. The Upper Hydrostratigraphic Unit at most of the RFP OUs include weathered bedrock. Secondary porosities and the presence of sand-bearing materials in the weathered bedrock of RCRA-regulated groundwater monitoring units must also be addressed prior to the full intent of the RCRA regulations being met by the groundwater monitoring systems at these units.

Groundwater monitoring procedures in general should be reviewed for consistency of wells used to measure the groundwater table. There is concern that bedrock wells in which the potentiometric surface is measured may incorrectly be included in alluvial groundwater table mapping or may not be monitoring the same bedrock hydrogeologic unit. However, use of water-level data in wells that have been measured within two days of sampling causes inaccurate measurements. This, as well as measuring water levels in well sumps when the actual groundwater level is below the screened interval, leads to incorrect interpretations of groundwater elevations.

Recommendations in the 1991 and 1992 *Annual RCRA Groundwater Monitoring* reports are nearly identical. RCRA groundwater monitoring requirements specify that identified deficiencies should be corrected *as soon as possible*. Making the same recommendations year after year does not meet this requirement.

Analytical results, including statistical evaluation of the results, are well documented and available at the offices of the operating contractor.

The statistical procedures used by RFP follow EPA guidelines for permitted facilities closely, which are considerably more technically detailed and conservative than the State regulations and cover a wider range and variety of sample populations as encountered in this field. The only significant criticism is in the presentation of the results, which does not explicitly point out the places where a statistical interpretation is likely to be questionable because of the nature of the data. Consequently, conclusions drawn from marginal data are prone to misinterpretation by a nonspecialist.

In summary, a better understanding and further characterization of each of the three regulated units are strongly recommended. Detection of constituent migration is questionable with the existing monitoring well network at each of the three regulated units.

## **GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

### **OBJECTIVE REQUIREMENT**

A sitewide groundwater monitoring well network should be in place so that the effects of operations on groundwater quality can be determined and documented

DOE 5400 1, General Environmental Protection Program, Chapter IV, Sections 1 6 and 9 require that groundwater that is or could be affected by DOE activities be monitored. The monitoring well network and associated monitoring program must be in place by November 9, 1991

Site-specific monitoring programs may also be mandated by EPA through enforcement of RCRA requirements

### **I. CRITERIA**

16. The surface and subsurface geology, stratigraphy and hydrostratigraphy has been defined and described, including regional setting and site-specific conditions. The descriptions include identification of aquifers, surface water/groundwater relationships, and local water-use factors.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Hydrology of a Nuclear-Processing Plant Site, Rocky Flats, Jefferson County, Colorado*  
(Hurr, 1976)

*RCRA Ground-water Monitoring Draft Technical Guidance* (U.S. EPA, 1993)

*Groundwater Program Compliance Report* (Wright Water Engineers, Inc., 1993)

*Permuting of Monitoring Wells at the Rocky Flats Plant* (Wright Water Engineers, Inc., 1993a)

*Well Evaluation Report Draft* (S M Stoller Corporation, et al., 1993)

*Bedrock Aquifers in the Denver Basin, Colorado - A Quantitative Water-Resources Appraisal* (USGS, 1987).

*Ground Water Resource of Bedrock Aquifers of the Denver Basin, Colorado* (SEO, 1976)

*Denver Basin Atlas Nos 1-4* (Van Slyke, et. al., 1988)

"Technical Memorandum No 8," *Revised Phase II RFI/RI Work Plan, OU 2* (DOE, 1993a)

Interview with Senior Hydrogeologist, EG&G

Interview with Project Hydrogeologist, Watkins-Johnson Environmental

Interview with Senior Environmental Engineer, EG&G

Interview with Senior Hydrologist, Advanced Sciences, Inc

Interview with Senior Groundwater Modeler, EG&G

#### Discussion:

The findings related to Criteria 16 were based entirely on an understanding of the regional and sitewide hydrology and hydrogeology. Thus, this is an evaluation of the gross understanding of the groundwater system at RFP, and the level of detail of this sitewide evaluation does not account for some of the detailed flow path analysis and groundwater quality discussed in the site-specific Criteria 15 and 27 through 30.

#### **IV. FINDINGS**

According to interviews with hydrogeologists from both EG&G and Watkins-Johnson Environmental, the regional surface and subsurface geology, stratigraphy and hydrostratigraphy of RFP have been defined on a "macro" scale. The regional hydrogeologic setting of the RFP has been relatively well defined since as early as 1976 when R T Hurr authored his U S Geological Open File Report 76-268 entitled *Hydrology of a Nuclear-Processing Plant Site, Rocky Flats, Jefferson County, Colorado*. However, the site-specific conditions of each of the geologic/hydrologic units is not as well-defined.

Those areas which are best defined on a "micro" scale occur in the general vicinity of the Industrial Area boundary. This better definition is the result of numerous boreholes and monitoring wells established to characterize the hydrogeology in potential contaminant pathways associated with OUs 1, 2 and 4. To date, very little effort has been directed toward correlation of the site-specific data obtained from OU and other studies to a sitewide understanding of the surface and subsurface geology. This will be part of the focus of a three-part Characterization Report planned to be completed in 1994. These characterization reports include a geologic report (update of the 1991 report), a groundwater geochemical report, and a physical hydrogeologic report.

Of special note to the understanding of the surface water/groundwater relationships in site-specific programs is the gain/loss study of surface flow in Woman Creek, conducted by an EG&G Senior Environmental Engineer in OU 5. This study, however, focused not on groundwater, but on the gaining and losing reaches of the stream channel for purposes of constructing an accurate surface flow model. Some effort was made to understand the hydrogeologic factors affecting the surface water/groundwater relationships by using well point data. This gain/loss study did not however account for complications arising from hillside seepage from seeps and springs.

Information gathered from seeps and springs by the Surface Water Division measured only water quality and not water quantity. However, a second surface water/groundwater relationship study which will consider both quality and quantity has been proposed in a recent work package. Presently, no contract has been awarded for the project.

The overwhelming majority of hydrogeologic characterization has been focused on the unconsolidated materials (i.e., Rocky Flats Alluvium, colluvium and valley-fill alluvium) and the immediately underlying bedrock formations of the Arapahoe and Laramie formations. Few investigations have been conducted on the deeper bedrock formation aquifers due to the thick intervening sequences of significantly lower permeability materials.

Some concern has been raised regarding the potential for migration of contaminants through continuous sand units or channel complexes within these formations, and/or faults or fracture systems which might have created more permeable contaminant pathways to deeper hydrogeologic units. The general consensus among the hydrogeologists interviewed is that the hydraulic conductivity of the underlying bedrock formations between the unconsolidated surficial deposits and the deeper aquifers (e.g., Laramie-Fox Hills) is substantially lower than that of the surficial deposits. Thus, the predominant groundwater flow direction is easterly, and is governed by the bedrock contact with the unconsolidated surficial materials. As evidenced at OU2, minor variations occur locally in the flow direction in the No. 1 sandstone.

To date, little effort has been made to conduct a hydrologic mass-balance study for RFP. The closest attempt has been the site-wide groundwater model currently under development. The input parameters required to calibrate the initial groundwater model should shed some light on the present understanding of the overall hydrologic mass balance at the RFP. However, an independent analytical mass balance would be useful for comparison against the results of the numerical model. The parameters of recharge, infiltration and evapotranspiration are being input as a net recharge value. This net recharge value is based on regional soil characterization from the Soil Conservation Service (SCS) and some limited specific recharge data. (A more site-specific recharge study is apparently underway and values generated by this work will be useful as input

parameters in future model iterations ) Averaged hydraulic conductivity values are being used to establish the initial parameters of the model Although stream-aquifer interaction was included in the model, other local water-use factors, such as recharge to the system via seepage from irrigation canals, have not been included

It was suggested that the "zero discharge studies" conducted by Advanced Sciences, Inc (ASI) may have included an attempt to construct a hydrologic mass balance for RFP However, these studies concentrated on the amount of water in storage rather than the total water in the system Such studies cited in the context of the hydrologic mass balance for RFP fall short of achieving this goal

According to hydrograph responses the present quarterly sampling program at RFP is generally adequate to detect seasonal or other temporal variations in groundwater flow However, the values of hydraulic conductivity for some of the sand units in the underlying bedrock formation are large enough to allow migration of potential contaminants over sufficient distances to warrant a more frequent monitoring program for wells constructed in these sand units In addition, sitewide analysis of the water level data collected quarterly should be evaluated on a regularly-scheduled basis

## **GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

### **I. CRITERIA**

17. The direction of groundwater flow has been defined for each aquifer or hydrostratigraphic unit. Contour maps showing the configuration of the piezometric surface of each unit are available.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Program Compliance Report* (Wright Water Engineers, Inc , 1993)  
*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)  
*Background Geochemical Report* (EG&G, 1991a)  
*Final Background Geochemical Characterization Report* (EG&G, 1990)  
*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)  
Annual RCRA reports (EG&G, 1991, EG&G, 1992, EG&G, 1993)

Interview with Senior Hydrogeologist, EG&G

Interview with Project Hydrogeologist, Watkins-Johnson Environmental

#### **Discussion:**

This criteria requires that RFP define the direction of groundwater flow in each aquifer and hydrostratigraphic unit on a sitewide basis. Details regarding groundwater flow at specific RCRA-regulated units and OUs are discussed in Criteria 15 and 27 through 30.

### **IV. FINDINGS**

Underlying the RFP are the unconsolidated upper hydrostratigraphic unit which includes the Rocky Flats Alluvium, colluvium, and valley-fill alluvium, and the No. 1 sand unit and the bedrock aquifers of the Arapahoe and Laramie-Fox Hills formations. Significant to the potential migration of contaminants from RFP via groundwater are the unconsolidated units and the immediately underlying bedrock formation. These two formations have had the most significant hydrogeologic characterizations completed. The piezometric surface of the unconsolidated hydrostratigraphic unit has been constructed on at least three occasions from water level data collected for various seasons of various

years. These include (1) an exhibit prepared by WWE for the January, 1991 Rocky Flats hearing before the WQCC, (2) Figure 2 2 3-1 in the GPMPP, and (3) Plates 2-10 and 2-11 in the 1993 *Well Evaluation Report Draft*. A reliable piezometric surface map for the bedrock formations underlying the RFP does not exist and should be constructed.

Deeper bedrock units or aquifers have not been characterized because of the thick and impermeable layers separating these deeper units from the more shallow water-bearing units. Typical bedrock wells do not exceed 150 to 200 feet in depth. The limited number of deeper wells reduce the amount of data points which are available to construct a defensible piezometric surface map of a bedrock unit.

Geophysical techniques have been used to assist in the characterization of the sand units identified in the shallow bedrock. To date, limited boreholes have been constructed to independently verify the delineation of sandstone units using geophysical techniques. However, the geophysical techniques have corroborated the location of sand units observed in some existing boreholes within the geophysical study area. Surficial techniques to define geologic features that control groundwater migration are questionable unless validated by borehole data.

Attempts have been made to use common ions to determine flow paths. These include numerous "plume maps" of analytes such as total nitrate+nitrite, total sulfate and metals in the *Well Evaluation Report Draft*. Additional data have been presented in the *Background Geochemical Report* and the *Geochemical Characterization Report* according to a Senior Hydrogeologist with EG&G. However, evaluations of distributions of these metals indicate their presence but not necessarily groundwater flow paths.

In summary, the most exhaustive work to characterize the piezometric surface and groundwater flow direction at RFP has been in the unconsolidated Quaternary deposits and bedrock units immediately underlying the unconsolidated deposits. These two units have had piezometric surface maps constructed for them which confirm a generally easterly groundwater flow direction, although the true piezometric surface within bedrock has not been correlated.

## **GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

### **I. CRITERIA**

18. If intermediate depth or deep aquifers are present, the vertical gradient between aquifers and intervening confining units has been determined.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Program Compliance Report* (Wright Water Engineers, Inc , 1993)  
*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)  
"Technical Memorandum No 8," *Revised Phase II RFI/RI Work Plan, OU 2* (DOE, 1993a)

Interview with Senior Hydrogeologist, EG&G

Interview with Project Hydrogeologist, Watkins-Johnson Environmental

#### **Discussion:**

None

### **IV. FINDINGS**

The lack of information regarding the vertical hydraulic gradient between the upper hydrostratigraphic units and deeper aquifers is an important shortfall of the hydrogeologic characterization at RFP. The relative difference in hydraulic conductivity between the unconsolidated material and the bedrock is significant enough to promote migration of groundwater along the bedrock surface (i.e., downgradient in an easterly direction). This general understanding is widely acknowledged and reduces the need for exhaustive studies of vertical hydraulic gradients.

A number of EG&G personnel have quantified the vertical gradient between hydrostratigraphic units as part of site characterization activities for OU 1 and OU 2. However,

these values have not been widely distributed or incorporated into a widely-distributed report

Forty locations where sets of wells that discretely screen the unconsolidated surficial deposits (alluvium, colluvium and valley-fill alluvium) and bedrock were evaluated in the *Well Evaluation Report Draft*. These locations consisted of 33 well clusters plus 7 groups of wells located in close proximity to each other. Of the 40 locations evaluated, 31 exhibited sufficient water level and well completion data to construct hydrographs. The gradient direction and the degree of hydraulic connection between lithostratigraphic units at RFP was assessed by comparing these hydrographs.

This evaluation did not quantify the vertical gradient between aquifers and confining units but rather provided a relative comparison of hydraulic connectivity and the gradient direction. According to a Watkins-Johnson Project Hydrogeologist, quantification of the vertical gradient between aquifers and confining units had not been completed previously. The majority of the cluster wells evaluated as part of this investigation were in the general vicinity of the plant site. Few cluster wells are located in the eastern reaches of RFP where the alluvium is thinnest and the underlying bedrock formations have likely been subject to more extensive weathering. Section 2.2.6 of the *Well Evaluation Report Draft* indicates that the easternmost zone of the RFP site may have "more vertical groundwater migration into bedrock than the central zone."

According to a Senior Hydrogeologist with EG&G, the quantification of the vertical gradient between various hydrostratigraphic units will be part of the work plan for the *Hydrogeologic Characterization Report* scheduled to be completed in 1994.

## **GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

### **I. CRITERIA**

19. Hydrogeologic characteristics such as hydraulic conductivity, transmissivity, saturated thickness, and effective porosity are available and are based on results of aquifer tests and field permeability tests. Reported values are based on checked calculations, and estimated values are based on reliable references or documents.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Program Compliance Report* (Wright Water Engineers, Inc , 1993)  
*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)

Interview with Senior Hydrogeologist, EG&G

Interview with Project Hydrogeologist, Watkins-Johnson Environmental

#### **Discussion:**

It is assumed that this criteria requires that the hydrogeologic characteristics of hydraulic conductivity, transmissivity, effective porosity and saturated thickness are available and checked for accuracy "Checked" in this case means that documentation exists to confirm the calculation

### **IV. FINDINGS**

A substantial amount of data has been generated from field testing regarding quantification of hydraulic conductivity, transmissivity, and saturated thickness. Limited field investigations of effective porosity have been conducted. Some validation has been completed on a selective site-specific basis, and there is presently a planned task to check the remaining hydrogeologic parameters. This funding is reportedly available to compile all data so that the graphical, analytical and mathematical calculations for each of these

parameters can be reviewed. Should insufficient data be available to reconstruct the calculations of these parameters, the test will be invalidated and the corresponding parameter values will be discarded.

As part of this program, up to 100 wells may be retested for purposes of obtaining validated hydrogeologic parameters through slug and/or aquifer testing. The focus of this program will be on obtaining valid data from new and/or existing wells in OU areas. These data may include slug and aquifer testing not only for parameter estimation but for well yields and long-term production rate determination. These data will assist remediation personnel with their long-range objectives.

## **GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

### **I. CRITERIA**

20. The monitoring-well network consists of sufficient stations to determine the quality of the groundwater entering and leaving the site. Comparisons between upgradient and downgradient conditions in all defined hydrostratigraphic units are possible in order to detect and evaluate potential off-site releases of contaminants.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)  
*Permuting of Monitoring Wells at the Rocky Flats Plant* (Wright Water Engineers, Inc , 1993a)  
*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities* (U.S EPA, 1989)

Interview with Senior Hydrogeologist, EG&G

#### **Discussion:**

For this criteria, "all defined hydrostratigraphic units" are considered as those units interpreted to be significant at RFP (i e , unconsolidated Quarternary deposits and immediately underlying bedrock)

### **IV. FINDINGS**

The discontinuous nature of the lithologic units of the underlying bedrock formations make it difficult to correlate these units across the entire RFP and, therefore, to compare upgradient and downgradient water quality in these units (An exception to this is the No 1 sandstone which has been correlated across the site, but is not necessarily continuous.) However, the relative impermeability of the unweathered bedrock is

sufficient to suggest that groundwater flow is toward the east to a series of boundary wells at Indiana Street

The particular issue of whether sufficient monitoring wells are available to determine the quality of groundwater entering and leaving the RFP has been the partial focus of the recently released *Well Evaluation Report Draft*. Included in this report are recommendations that additional wells be constructed both upgradient of the Industrial Area immediately east of Highway 93 (for a better understanding of the groundwater quality entering the site), and in an area between the Industrial Area and Indiana Street (for a better understanding of the quality of groundwater leaving the site). The wells along Indiana Street in this area are not appropriately screened to differentiate between the quality of the groundwater among upper and lower hydrostratigraphic units. Similarly, given the complexity of the geologic configuration at RFP as evidenced in reports such as "Technical Memorandum (TM) No. 8" for OU 2, additional wells at Indiana and/or upgradient are advisable.

A Senior Hydrogeologist with EG&G is in general agreement that an insufficient number of wells are located both upgradient and downgradient of the plant site. At downgradient locations, insufficient information is known about the hydrogeologic system and installations of additional wells will allow further characterization. To adequately characterize the quality of the water entering the site at upgradient locations, the effects of the subcropping Fox Hills formation has on groundwater flow as it migrates toward the RFP should also be evaluated.

## GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK

### I. CRITERIA:

21. Well locations and depths must be supported by an adequate characterization of the overall hydrogeologic setting of the site.

### II. PRIMARY REGULATORY DRIVER

DOE Order 5400 1

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*RCRA Ground-water Monitoring Technical Enforcement Guidance Document* (U S EPA, 1986)

*Final Background Geochemical Characterization Report* (EG&G, 1990)

*Well Abandonment and Replacement Program Plan* (DOE, 1992b)

*EMD Operating Procedures - Manual No 5-21000-OPS-GT, Volume III - Geotechnical* (EG&G, 1993a)

*Groundwater Program Compliance Report* (Wright Water Engineers, Inc , 1993)

*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)

*Final Phase I RFI/RI Work Plan for OU 9* (EG&G, 1992a)

Technical Memorandum No 9, " *Final Phase RFI/RI Work Plan for OU 5* (EG&G, 1993i)

Interview with Senior Hydrogeologist, EG&G

Interview with Project Hydrogeologist, S M Stoller Corporation, et. al

#### Discussion:

This criteria requires that well locations and depths be supported by current understanding of the the overall site hydrogeology, which is derived from sources such as existing reports and well data

#### IV. FINDINGS

Wells constructed to provide background geologic, hydrogeologic and geochemical characterization upgradient of the facility and in the Rock Creek drainage, and those wells constructed as boundary wells for determination of the quality of groundwater leaving the site, were constructed in accordance with this criteria. However, the locations of the majority of wells on the RFP have been selected as the result of site-specific investigations to determine the extent of and potential for migration pathways of contaminant releases at the site, and not based on existing information detailing the overall hydrogeologic setting. Some OU work plans reference the *Background Geochemical Characterization Report* and the *Geologic Characterization Report* to determine OU-specific well locations. However, a sitewide hydrogeologic characterization report would be a more valuable reference. Such a report does not currently exist.

Part of the purpose of the recently completed *Well Evaluation Report Draft* was to evaluate the usefulness of the well locations and depths for characterization of the overall hydrogeologic setting of the site. This report indicates a need for additional well locations to more adequately characterize the overall hydrogeologic setting of RFP. This investigation is reported to be the first attempt to evaluate the monitoring well network of RFP for the purpose of characterizing the entire hydrogeologic system.

## GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK

### I. CRITERIA

22. Construction of all monitoring wells is fully documented.

### II. PRIMARY REGULATORY DRIVERS

DOE Order 5400 1

Rule 10 - Minimum Well Construction Standards. As specified in the *Revised and Amended Rules and Regulations of the Board of Examiners of Water Well Construction and Pump Installation Contractors* prepared by the SEO effective July 30, 1988

Rule 11 - Monitoring and Observation Holes and Test Holes. As specified in the *Revised and Amended Rules and Regulations of the Board of Examiners of Water Well Construction and Pump Installation Contractors* prepared by the SEO effective July 30, 1988

Rule 15 - Reporting Requirements As specified in the *Revised and Amended Rules and Regulations of the Board of Examiners of Water Well Construction and Pump Installation Contractors* prepared by the SEO effective July 30, 1988

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*RCRA Ground-water Monitoring Technical Guidance* (U S EPA, 1993)  
*EMD Operating Procedures, Manual No 5-21000-OPS-GT, Volume III - Geotechnical* (EG&G, 1993c)  
*Revised and Amended Rules and Regulations of the Board of Examiners of Water Well Construction and Pump Installation Contractors* (SEO, 1988) Rule 10, 11 and 15.  
*Permitting of Monitoring Wells at the Rocky Flats Plant* (Wright Water Engineers, Inc., 1993a)

Interview with Project Manager, Well Abandonment and Replacement Program, EG&G  
Interview with Senior Hydrogeologist, EG&G.

#### Discussion:

In this criteria "all" is interpreted as

- All wells and piezometers in the groundwater monitoring network and excludes boreholes

"Fully" means that

- The well has a specific legal location and identity
- For each well, a "Well Construction and Test Report Form" (Form No GWS-32) or equivalent was completed, signed by the contractor and submitted to the SEO in a timely fashion
- For each well, a well permit application has been completed, signed, submitted to the SEO and approved by the SEO by granting a permit number

#### IV. FINDINGS

Document review shows that approximately 650 monitoring wells and piezometers have had permit applications prepared and submitted to EG&G for review, signature and submittal to the SEO. In addition, 94 well abandonment reports were completed and submitted to EG&G. Many of the permit applications were incomplete with respect to casing depth, screen length, and screened interval which were not available and, therefore, not included on the application.

The number of wells with missing or partial data regarding construction indicates that full documentation of the construction of all monitoring wells is not complete. The Well Abandonment and Replacement Program (WARP) is designed to abandon and replace, if appropriate, wells with limited construction information. Should undocumented wells be located, they will be evaluated under the WARP program.

## GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK

### I. CRITERIA

23. Plugging and abandonment of all wells and boreholes are fully documented.

### II. PRIMARY REGULATORY DRIVERS

DOE Order 5400 1

Rule 11 - Abandonment Standards: As specified in the *Revised and Amended Rules and Regulations of the Board of Examiners of Water Well Construction and Pump Installation Contractors* prepared by the SEO effective July 30, 1988

(SOPs)

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*RCRA Ground-water Monitoring Technical Guidance* (U S EPA, 1993)  
*Revised and Amended Rules and Regulations of the Board of Examiners of Water Well Construction and Pump Installation Contractor* (SEO, 1988).  
*Well Abandonment and Replacement Program Plan* (DOE, 1992b)  
*EMD Operating Procedures - Manual No 5-21000-OPS-GT, Volume III - Geotechnical* (EG&G, 1993c)  
*Groundwater Program Compliance Report* (Wright Water Engineers, Inc , 1993)  
*Permutting of Monitoring Wells at the Rocky Flats Plant* (Wright Water Engineers, Inc , 1993a)  
*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)

Interview with Project Manager, Well Abandonment and Replacement Program, EG&G  
Interview with Field Geologist, Roy F Weston.

**Discussion:**

Criteria 23 is assumed to apply to only those wells and boreholes which have been plugged or abandoned. Rule 11 requires for each abandoned well

- A specified legal location and identity have been assigned
- A well abandonment form (Form No GWS-9) or equivalent, has been completed, signed and submitted to the SEO in a timely manner

Fully documented is assumed to mean that the wells were abandoned in accordance with SOPs GT 11, GT 05 and other relevant SOPs identified therein

**IV. FINDINGS**

The WARP was developed to mitigate the potential for contaminant migration via improperly constructed or damaged wells and piezometers, and to ensure the integrity of the groundwater monitoring data obtained from RFP wells and piezometers

The WARP criteria were identified in the November 1990 *Rocky Flats Plant Well Abandonment and Replacement Program Plan* (WAPP), and were applied to existing RFP monitoring wells and piezometers identified in the January 1991 *Well Evaluation Report Draft* for abandonment

From January to September 1992, 47 monitoring wells were abandoned. As part of the 1993 program, an additional 36 monitoring wells have been or will be abandoned. An additional 28 monitoring wells are recommended for abandonment in the 1994 WARP program as outlined in the *Permitting of Monitoring Wells at the Rocky Flats Plant* report. Prior to implementation of the WARP in 1992, an additional 11 monitoring wells were abandoned

Wright Water Engineers, Inc. has prepared SEO abandonment forms for each of the 94 monitoring wells abandoned to date and transmitted them to EG&G for review. EG&G has submitted these forms to DOE for signature and submittal to the SEO

Prior to 1985, neither criteria nor SOPs existed for abandonment and plugging of wells and boreholes. Documentation of any abandonment prior to 1985 is limited at best. Since 1985, criteria and/or SOPs have been in place for abandonment and plugging of both wells and boreholes. Presently, the governing SOPs are GT.05 ("Plugging and Abandonment of Boreholes") and GT.11 ("Plugging and Abandonment of Wells")

Although some type of standards have been in place since 1985, it cannot be verified that all monitoring wells and boreholes have been abandoned according to the current SOPs. According to the *Well Evaluation Report Draft*, most wells at RFP with incomplete documentation, physical damage, or improper construction have been abandoned. Although SOP GT 05 exists for the plugging and abandonment of boreholes, documentation for abandoned boreholes has not been assembled into a coherent package. The WARP project manager indicated reasonable confidence that full documentation of the abandonment of wells has been completed, and that it is possible that additional pre-1985 wells may be identified in the future.

The history of criteria for abandonment of boreholes coincides with those for monitoring wells and piezometers. SOP GT 05 requires completion of an abandonment form. Numerous reports chronicle the construction of wells and boreholes prior to 1985. Many of these sites cannot be located today. It is unknown how, if at all, these wells and boreholes were abandoned and under what criteria. Full documentation of abandonment or plugging of pre-1985 boreholes is unlikely. Documentation of borehole abandonment is most thoroughly documented from 1989 to present. Potential documentation of abandoned boreholes may be found by reviewing characterization plans and reports for specific sites and field programs.

## **GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

### **I. CRITERIA**

24. Well inspection and maintenance records are available.

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*EMD Operating Procedures - Manual No 5-21000-OPS-FO, Volume I - Field Operations*  
(EG&G, 1993a)

*EMD Operating Procedures - Manual No 5-21000-OPS-GW, Volume II - Groundwater*  
(EG&G, 1993b)

*EMD Operating Procedures - Manual No 5-21000-OPS-GT, Volume III - Geotechnical*  
(EG&G, 1993c)

Interview with Field Supervisor, Field Services, EG&G

Interview with Site Supervisor, Woodward-Clyde Federal Services

#### **Discussion:**

This criteria requires that inspection of wells occurs and that well inspection and maintenance records are available for review by interested parties

### **IV. FINDINGS**

A review of the SOPs governing field operations, groundwater and geotechnical services at RFP found limited guidelines or procedures governing the recording or tracking of well inspection and maintenance data. An SOP does require that total depth be measured, recorded and compared to the "as-built" depth as a means to assess sediment accumulation in the well.

There is a "comments" section on the "Ground Water Levels Measurements/Calculations" Form GW 01A (rev 1 4) in which field personnel are to note the condition of a well at the time of water level monitoring. A similar "comments" section is now available on the "Ground Water Sample Collection Log," Form GW 06B (Rev 2 1) as per DCN 93 02. The "comments" sections of these field forms are not dedicated to notations regarding well conditions and are too small to record useful information. However, there is no tracking mechanism to determine whether conditions which require special attention at the well site were addressed. A formal tracking mechanism should be instituted to ensure that any irregularities noted by field personnel are adequately addressed.

A check box should be added to the forms as a guarantee that well conditions have been noted. Specific suggestions or requirements to improve the condition of the well should be noted in a dedicated "comments" section. As an alternative, a series of check boxes indicating the condition of the well (Good, Fair or Poor) could be added to the field forms with a comments section available for those wells rated as fair or poor.

## **GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK**

### **I. CRITERIA**

25. Standard operating procedures exist for borehole drilling, well construction, disposal of borehole cuttings and drill fluids, well inspection and maintenance, and well abandonment.

### **II. PRIMARY REGULATORY DRIVERS**

DOE Order 5400 1

SOPs

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*EMD Operating Procedures - Manual No 5-21000-OPS-FO, Volume I - Field Operations*  
(EG&G, 1993a)

*EMD Operating Procedures - Manual No 5-21000-OPS-GT, Volume III - Geotechnical*  
(EG&G, 1993c)

#### **Discussion:**

This criteria relates only to the existence of SOPs, and not to their proper field implementation

### **IV. FINDINGS**

Review of the *EMD Operating Procedures - Manual No 5-21000-OPS-FO, -GW, and -GT, Volumes I, II and III*, indicates that there are SOPs for borehole drilling, well construction, disposal of borehole cuttings and drill fluids, and well (and borehole) abandonment. This review also indicates there is no SOP for well inspection and maintenance. This particular issue is detailed in Criteria No 24 of this assessment.

During review of the SOPs, some specific issues arose that merit comment. These are as follows:

Borehole Drilling - GT.02 and .04

- 1 The "Purpose and Scope" section of the SOP should indicate the purpose of these SOPs (e.g., to standardize the procedures for drilling a borehole).
- 2 Another reference for these SOPs should be *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*, EPA/600/4-89/034, March 1991.
- 3 No discussion is provided which indicates what should be done when boreholes are left overnight before completion as a well the next day. If this is prohibited, it should be stated; if not, a proper procedure should be described.
- 4 Both SOPs indicate part of the required equipment is a high pressure steamer/sprayer. Since all equipment is to be decontaminated at the decon pad, no steamer/sprayer is necessary in the field.
- 5 These SOPs do not discuss what equipment and materials should be decontaminated and when. If this information is covered in another SOP, it should be referenced appropriately; if not, appropriate language should be added.

Well Construction - GT 06

- 6 The "Purpose and Scope" section of this SOP should indicate the purpose of the SOP (e.g., to standardize the procedures for constructing a well).
- 7 This SOP is inflexible regarding the selection of well screen size. Although the SOP states that the filter pack can be modified if specified in the Field Sampling Plan, there is no provision for modifying the well screen size even if the filter pack is changed or if lithologic conditions encountered in the field warrant such a change. Proper well design impacts the sampling program because of its influence on the flow of water into a well and the amount of suspended sediment which enters a well.
- 8 Section 5.3.1.4 indicates the well should have a 3-foot bentonite seal whereas the diagrams and the corresponding Section 5.3.2.1 indicate that this thickness is 2 feet.

- 9 This SOP specifies (in some cases) the filling of the borehole annulus to the surface with bentonite grout and subsequently chipping out the grout for installation of the protective steel casing. This may create undue stress on the well casing.
- 10 Form GT.06A (Rev 2) of this SOP indicates centralizers may be used. There is no specification in this SOP indicating when to use and where to place centralizers.

#### Disposal of Borehole Cuttings and Drill Fluids - FO 08

- 11 The "Purpose and Scope" section of this SOP should indicate the purpose of the SOP (e.g., to eliminate potential contamination of surficial materials).
- 12 Contrary to statements made in SOP FO 8 and FO 5, the main decontamination facility will not accept drilling fluids containing moderate to high concentrations of suspended solids. An SOP should be developed to address disposal of these materials.

#### Well Maintenance and Inspection

- 13 SOPs for these activities do not exist.

#### Abandonment of Boreholes and Wells - GT.05 and .11

- 14 The "Purpose and Scope" sections of these SOPs should indicate the purpose of the SOP (e.g., to eliminate vertical fluid migration along the borehole and to eliminate wells and/or boreholes without sufficient information to determine the hydrostratigraphic unit being sampled or observed).
- 15 These SOPs do not discuss what equipment and materials should be decontaminated and when. If this information is covered in another SOP, it should be referenced appropriately, if not, appropriate language should be developed.
- 16 Section 7.1 of GT 11 indicates that "after cleaning and/or decontamination, the casing will be screened and stacked into piles..." It is unclear from this sentence exactly what type of screening (e.g., radiological) is required.

## GW3 SITEWIDE GROUNDWATER MONITORING WELL NETWORK

### I. CRITERIA

26. Where groundwater flow models have been used to establish or to evaluate the monitoring well network, model documentation, including code testing and field verification, where applicable, are available.

### II. PRIMARY REGULATORY DRIVER

DOE Order 5400 1

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*EMD Operating Procedures - Manual No 5-21000-OPS-FO, Volume I - Field Operations*  
(EG&G, 1993a)

*EMD Operating Procedures - Manual No 5-21000-OPS-GW, Volume II - Groundwater*  
(EG&G, 1993b)

*EMD Operating Procedures - Manual No 5-21000-OPS-GT, Volume III - Geotechnical*  
(EG&G, 1993c)

*Selection of Exposure Scenarios, Computer Models, and Data Collection Requirements  
for Human Health Risk Assessments* (Dames & Moore, 1991)

*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)

*Draft Project Manager's Guide to Ground Water Model Selection at Sites Contaminated  
with Radioactive Substances* (U S EPA/NRC, 1993)

Interview with Senior Groundwater Modeler, EG&G

Interview with Senior Hydrogeologist, EG&G

#### Discussion:

This criteria is interpreted to require that groundwater models be used to establish or evaluate the monitoring well network

#### IV. FINDINGS

A sitewide groundwater flow model exists but has not been used to establish or evaluate the monitoring well network (Most of the monitoring wells at RFP were installed prior to the availability of this model ) The model may be used in the future to evaluate or refine the monitoring well network

During an interview, the Senior Groundwater Modeler was asked if there is a guidance document which was followed regarding the selection of a groundwater flow model for use at RFP He indicated that Dames & Moore had completed a document for Human Health Risk Assessments which addressed, on a generic level, the requirements of a groundwater model from the basis of defensibility and public use He further stated that a version of a report by the U S EPA/NRC was given to him for review which discussed some general guidelines for using groundwater flow models on sites contaminated with radioactive substances He emphasized that the U S EPA only provided general guidelines for model selection and use, and does not mandate which models are to be used

The Senior Groundwater Modeler indicated that there has not been nor will there be any groundwater program code written by his group Rather, reputable public domain software is currently being used which ensures code testing has been conducted Once software is loaded, all example problems are run to verify the proper installation of the software Field verification (i e , calibration) of any model is standard practice for all groundwater modeling efforts at RFP

## **GW4 HYDROGEOLOGIC CHARACTERIZATION OF RCRA AND/OR CERCLA SITES**

### **OBJECTIVE REQUIREMENT**

Actions should be in progress for hydrogeologic characterization of individual Solid Waste Management Units (SWMUs) and inactive waste sites identified either through a RCRA Facility Assessment (RFA) or a CERCLA Preliminary Assessment/Site Inspection (PA/SI)

DOE 5400 3, Hazardous and Radioactive Mixed Waste Program, requires compliance with RCRA

DOE 5400 4, Comprehensive Environmental Response, Compensation and Liability Act Requirements, requires DOE facilities to comply with applicable portions of CERCLA

Existing consent decrees or orders or permit requirements from local, state or federal regulatory agencies may set forth compliance schedules for SWMUs and inactive waste sites

### **I. CRITERIA**

27. A written plan for hydrogeologic characterization has been prepared. The plan contains specific goals for each phase of the site characterization. The goals are related to obtaining data from tests, measurements and analyses needed to design and implement a Groundwater Protection Strategy.

### **II. PRIMARY REGULATORY DRIVERS**

CERCLA  
Colorado Hazardous Waste Act  
DOE Order 5400 1  
DOE Order 5400 3  
DOE Order 5400 4  
IAG  
RCRA

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*Well Evaluation Report Draft* (S M Stoller Corporation, et al, 1993)

*Interagency Agreement* (DOE et al, 1991)

*EMD Operating Procedures Manual No 5-21000-OPS-GT Volume III - Geotechnical*  
(EG&G, 1993c)

*Final Ground-Water Assessment Plan* (DOE, 1993)

*Final Phase I RFI/RI Work Plan for OU 9* (EG&G, 1992a)

*Draft Final Phase I RFI/RI Work Plan for OU 5* (DOE, 1992)

"Technical Memorandum No 9," *Final Phase I RFI/RI Work Plan for OU 5* (EG&G, 1993i)

"Technical Memorandum No 8," *Final Revised Phase II RFI/RI Work Plan for OU 2*  
(DOE, 1993a)

Interview with OU 5 and 6 Manager, EG&G

Interview with OU 3 Manager, EG&G

Interview with Industrial Area IM/IRA Project Manager, EG&G

Interview with Senior Hydrogeologist, EG&G

Interview with Groundwater Program Manager, EG&G

#### Discussion:

This criteria is assumed to apply only to identified Individual Hazardous Substance Sites (IHSSs) and inactive waste sites that fall under the purview of RCRA and/or CERCLA as outlined in the Audit Objective GW4. For the purposes of this criteria, the word "site" is assumed to apply to individually identified OUs. Characterization of the overall RFP site is more fully discussed in Audit Objective GW3, Criteria 16 through 19.

### IV. FINDINGS

As required by the IAG, written plans for hydrogeologic characterization of individual IHSSs (which is an RFP term roughly equivalent to SWMUs at other RCRA/CERCLA sites) and inactive waste sites are incorporated into Phase I RFI/RI Work Plans for individual OUs. Depending on the results of Phase I investigations, additional investigatory work may be performed as part of Phase II RFI/RI efforts.

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Phase I RFI/RI Work Plans exist for all identified OUs, however, individual IHSSs within OUs are typically not hydrogeologically characterized separately from the overall OU. OUs which have conducted site-specific hydrogeologic characterizations in order to guide remedial action plans for these sites include OUs 1, 2, 4, 5, 6, 7 and 11. Other OUs, including OUs 8, 9, 10, 12, 13, 14 and 16, depend primarily on the sitewide data that have been generated. OU 3 (off-site releases) has not been hydrogeologically characterized, and OU 15 (inside building closures) does not warrant hydrogeologic characterization at this time. It should be noted that OUs 8, 9, 10, 12, 13 and 14 are being addressed concurrently as an "Integrated" OU due to the substantial overlap among individual OUs.

A review of the *Well Evaluation Report Draft*, GPMPP, *Background Geochemistry Report* and individual OU Work Plans indicates that some deficiencies do exist in the collection of site-specific hydrogeologic data:

- 1 Well coverage of the Industrial Area appears inadequate to completely characterize all individual IHSSs within the Industrial Area or to characterize UBC. Additional hydrogeologic characterization within the Industrial Area is needed.
- 2 Site-specific hydraulic conductivities, permeabilities and porosities have only been determined at some OUs. Other OUs rely on sitewide values that have not been confirmed within the OU.
- 3 Fractures and fault zones are noted on geologic logs but characterization of these zones with respect to contained material, and the extent and direction of the fracture zone and its potential to function as a contaminant flow path, has been limited.
- 4 Geologic logging (i.e., soil profiles) of the vadose zone within the Industrial Area, and particularly associated with test pits planned along the alignment of the original process waste lines (OPWL) (OU 9), has generally not included a determination of physical parameters (conductivity, permeability, porosity) which govern percolation rates.
- 5 The extent of caliche material and its impact on groundwater quality and quantity has not been fully characterized on either a sitewide or site-specific basis.

Sitewide hydrogeologic characterization efforts have also been conducted, and support the RFI/RI work efforts at individual OUs. These sitewide efforts include the 1993 *Well Evaluation Report*, the Background Geochemical Characterization reports and the 1992 *Sitewide Phase II Geologic Characterization Plan*, among others. None of these plans or reports are IHSS- or OU-specific, but they do support the sitewide GPMPP.

Historically, it appears that hydrogeologic characterization efforts at individual OUs were conducted independently of sitewide efforts, due to site-specific requirements which are different from those of the sitewide program. There has been little coordination between individual OUs and the sitewide program. The Geosciences Division is attempting to correct this situation by requiring their sign-off on all well permits and well construction drawings. As discussed in Criteria 9, a formal procedure to this effect is not in place and is needed.

In summary, written plans for hydrogeologic characterization have been prepared in accordance with IAG requirements. Each of these documents contains specific goals. Although extensive hydrogeologic data have been gathered to adequately characterize most individual RCRA and/or CERCLA sites, additional characterization of fault and fracture zones and vadose zone soil profiles is recommended. Additional wells are also recommended within the Industrial Area to provide better characterization of hydrogeologic conditions in the vicinity of specific IHSSs.

## **GW4 HYDROGEOLOGIC CHARACTERIZATION OF RCRA AND/OR CERCLA SITES**

### **I. CRITERIA**

28. All on-site sources or potential sources of contamination have been identified based on RFA, PA/SI or related investigations of both production and waste management operations and off-site contamination that has resulted from on-site sources has been identified.

### **II. PRIMARY REGULATORY DRIVER**

CERCLA  
Colorado Hazardous Waste Act  
DOE Order 5400 1  
DOE Order 5400 3  
DOE Order 5400 4  
IAG  
RCRA

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Historical Release Report* (DOE, 1992a)  
*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)  
*Interagency Agreement* (DOE et al , 1991)  
*Draft Comprehensive Environmental Assessment and Response Program* (DOE, 1985)  
*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)

#### **Discussion:**

This criteria requires that sources or potential sources of groundwater contamination be identified in a manner that ensures these sources are included in sitewide investigation/remediation plans

#### IV FINDINGS

According to the GPMPP, the *Comprehensive Environmental Assessment and Response Program* (CEARP) of 1985 originally identified 178 SWMUs as sources or potential sources of contamination at RFP. These 178 sites were included in an Appendix to the RCRA Part B permit application in 1986, and were incorporated into the IAG as IHSSs in 1991. These 178 IHSSs are grouped into 16 OUs for characterization and remediation purposes.

The HRR, required by the IAG, was intended to identify all spills, leaks, incidents, etc. by which contamination could have come to be located at a discrete location at RFP or at off-site locations. This HRR is currently being revised to include air releases and address comments received from the regulatory agencies. Some new release sites that qualified as IHSSs were identified in the HRR. These release sites have been added to existing OUs or could be addressed as a new OU. The "new" IHSSs identified in the HRR were relatively minor, however. The general consensus among site and regulatory personnel is that all major sources or potential sources of contamination have been identified.

Outside the RFP Industrial Area, individual IHSSs and inactive waste sites which are sources or potential sources of contamination have been adequately identified and are being, or will be characterized and remediated as part of specific OU actions. Within the RFP Industrial Area, there is substantial overlap between the OUs (OUs 8, 9, 10, 12, 13 and 14) such that a consolidated, or "integrated" approach is being used to characterize and address contaminated or potentially contaminated areas. Of particular note is the presence of UBC, which has been documented by various programs and incidents. The source of this UBC, whether from historic releases, past practices or current operations, and the discrete location of this contamination have not been identified to date.

Source control programs to investigate the water quality of foundation drain effluents and building sumps, to identify building floor drains that are connected to sewer lines, and to identify the location and contents of all above-ground and underground storage tanks are in place. However, these programs are not coordinated with OU characterization activities or with the sitewide groundwater monitoring program.

Potential new contaminant sources resulting from D&D of buildings have not been identified as yet. This need has been noted by the TSIP, which is developing requirements for conducting D&D activities. The TSIP has also noted that there are currently no procedures in place to implement specific groundwater monitoring requirements for individual buildings. As part of the Industrial Area IM/IRA, general recommendations regarding groundwater monitoring during D&D will be developed.

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According to the OU 3 Manager, characterization of off-site surface soils, reservoir sediment and surface water quality is complete, although the final RI/RFI report has not been published. Characterization and monitoring of the hydrogeology and groundwater regime beneath Great Western Reservoir (GWR), Standley Lake, Mower Reservoir, and Walnut Creek and Woman Creek east of Indiana Street were judged to be unnecessary by the OU 3 RFI/RI work plan and were not conducted. No wells were drilled to confirm off-site hydrogeology east of Indiana Street. One well below each of the two major downstream reservoirs (Standley Lake and GWR) was installed specifically to monitor potential solute transport through reservoir sediments. No monitoring of off-site private wells has been conducted.

In summary, all major on-site sources have been identified, however, sources of contamination associated with buildings within the Industrial Area have not been located precisely enough to allow remediation or other control activities. Information from other programs, particularly the Drains Identification Study, and the Underground Storage Tank program, has not been used for OU characterization activities or by the sitewide Groundwater Monitoring Program. Characterization of off-site contamination resulting from on-site sources and events has been completed and no additional off-site characterization is planned.

## **GW4 HYDROGEOLOGIC CHARACTERIZATION OF RCRA AND/OR CERCLA SITES**

### **I. CRITERIA**

29. The contaminants of concern have been defined as a result of specific studies of SWMUs or inactive waste sites or from routine sampling based on the site environmental monitoring program.

### **II. PRIMARY REGULATORY DRIVER**

CERCLA  
Colorado Hazardous Waste Act  
Colorado Water Quality Control Act  
DOE Order 5300 1  
DOE Order 5300 3  
DOE Order 5300 4  
IAG  
RCRA

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Classifications and Water Quality Standards for Ground Water* (CDH/WQCC, 1993)  
*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)  
*Interagency Agreement* (DOE et al, 1991)  
*IM/IRA Decision Documents for Operable Unit 1 and Operable Unit 2*  
*Final Phase I RFI/RI Work Plan for OU 9* (EG&G, 1992a)  
*Draft Final Phase I RFI/RI Work Plan for OU 5* (DOE, 1992)  
*"Technical Memorandum No 9," Final Phase I RFI/RI Work Plan for OU 5* (EG&G, 1993i)  
*"Technical Memorandum No 8," Final Revised Phase II RFI/RI Work Plan for OU 2* (DOE, 1993a)  
*Well Evaluation Report Draft* (S M Stoller Corporation, et al, 1993)

**Discussion:**

For the purposes of this criteria, only the identification of contaminants of concern was evaluated. This criteria does not consider the adequacy of the statistical method used to determine a contaminant of concern. In addition, a SWMU is considered to be the equivalent of an IHSS.

**IV. FINDINGS**

A preliminary list of potential contaminants of concern at an individual OU is developed from historical knowledge for use in OU-specific characterization efforts. Once characterization efforts are complete, a final list of contaminants of concern is determined as part of OU-specific remediation plans. Using this process contaminants of concern were defined for the OUs 1, 2 and 4 Interim Remedial Actions, in documents which were approved by regulatory agencies. Individual contaminants of concern are generally not determined for individual IHSSs within an OU because the process of grouping IHSSs into OUs considered the similarities in contaminant characteristics. Final contaminant of concern lists for OUs still in the assessment (e.g., RI/FS) stage have yet to be completed. Data from both OU-specific wells and sitewide network wells selected as applicable to that OU are used in determining contaminants of concern.

To provide an adequate level of coverage, all wells are currently sampled for an extensive analyte list approved by DOE, that includes all parameters of interest on a sitewide basis and does not consider OU-specific conditions. The *Well Evaluation Report Draft* proposes a change in the analyte list to make it more specific to individual wells.

**GW4 HYDROGEOLOGIC CHARACTERIZATION OF  
RCRA AND/OR CERCLA SITES**

**I. CRITERIA**

30. The rate and extent of groundwater contamination attributed to the facility or affecting the facility have been defined, including off-site sources or off-site migration of contaminants.

**II. PRIMARY REGULATORY DRIVER**

Agreement in Principle  
CERCLA  
DOE Order 5400 1  
DOE Order 5400 3  
DOE Order 5400 4  
IAG  
RCRA

**III. BASIS OF OPINION**

**Documents Reviewed and Personnel Interviewed:**

*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)  
*Well Evaluation Report Draft* (S M Stoller Corporation, et al , 1993)  
*Interagency Agreement* (DOE et al., 1991)  
*Final Ground Water Assessment Plan* (DOE, 1993)  
*Final Phase I RFI/RI Work Plan for OU 9* (EG&G, 1992a)  
*Agreement in Principle* (DOE and State of Colorado, 1989)  
*EMD Operating Procedures Manual No 5-21000-OPS-GT Volume I - Final Operations*  
(EG&G, 1993a)

Interview with Manager, Integrated OU, EG&G  
Interview with Manager, Groundwater Program, EG&G  
Interview with Project Manager, Industrial Area IM/IRA, EG&G

**Discussion:**

This criteria is assumed to apply only to individual SWMUs and inactive waste sites, and not to the overall RFP site. For the purposes of this criteria, "facility" is defined as a specific RCRA or CERCLA site, which in the case of Rocky Flats means an identified OU. "Off-site" means outside the boundaries of RFP. Sitewide issues regarding groundwater movement are addressed in Criteria 16-20.

**IV. FINDINGS**

As described in Criteria No. 20, boundary wells monitor on-site and off-site contaminants. Based on the available information, groundwater quality at the OUs has not been impacted by off-site sources. In addition, review of the *Well Evaluation Report Draft* indicates no off-site migration of contaminants in groundwater has occurred from any OU. Isolated detections of contaminants have been recorded at the Indiana Street wells. These detections were either not repeated during subsequent sampling, or were not traceable to an OU.

The rate and extent of groundwater contamination appears to be adequately defined on an OU-specific basis, with the exception of OUs 8, 9, 10, 12, 13 and 14, which are all located within the RFP Industrial Area. Due to the close proximity and overlapping nature of many OUs and the random placement of wells within the Industrial Area, the groundwater monitoring program is unable to confirm the rate and extent of groundwater contamination attributable to specific OUs within the Industrial Area. In addition, the extent of potential cross-contamination between IHSSs has not been defined. This is the primary reason why the Industrial Area and its associated OUs are being addressed concurrently rather than as distinct entities.

IHSSs within the Industrial Area generally impact the vadose zone to a much greater extent than they impact groundwater directly. Thus, the most likely groundwater contamination scenario involves water percolating through contaminated soil materials prior to reaching the water table. Flow paths and percolation rates within the vadose zone of the Industrial Area have not been defined, and according to the Field Sampling Plan for OU 9, soil samples for the determination of hydraulic parameters (porosity, permeability, conductivity) are not specified as part of Phase I characterization efforts.

OU work plans are designed to detect the necessary characterization to estimate the rate and extent of groundwater contamination migration. The rate and extent of contaminant migration at OU 1, 2, 4, 7 and 11 have been defined. However, additional work may be needed at OUs 7 and 11.

Investigations of the location of faults and fractures, sitewide or within individual IHSSs or OUs, and the effect on contaminant transport are just beginning. Additionally, review of the 1993 *Well Evaluation Report Draft* indicates potential vertical migration of contamination has not been fully characterized.

ADDITIONAL  
GROUNDWATER CRITERIA  
COMPLIANCE REVIEW

## **ADDITIONAL GROUNDWATER CRITERIA COMPLIANCE REVIEW**

### **I CRITERIA**

31. What does 10 CFR 834 require and how do these requirements differ from Order 5400.1? Does EG&G have a system to track other upcoming regulatory changes?

### **II. PRIMARY REGULATORY DRIVER**

DOE Order 5400 1

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

Interview with Manager, Groundwater Program, Geosciences Division, EG&G

Interview with Division Manager, Geosciences Division, EG&G

#### **Discussion:**

On March 25, 1993 DOE published a proposed rule regarding Radiation Protection of the Public and the Environment. The rule covers four basic areas which are set forth in Subparts B, C, D and E and is intended to protect the public and the environment from releases of radioactive material from DOE facilities. Subpart E will essentially codify the environmental monitoring and groundwater protection requirements of DOE Order 5400 1.

Subpart E, entitled Environmental Radiological Protection Program (ERPP), requires that all DOE activities be managed in accordance with an ERPP for the operation. An ERPP is to be comprised of plans, programs and other procedures to protect the public from radiation exposure from each DOE activity. An ERPP is to include a Groundwater Protection Management Plan and Environmental Monitoring Plan.

Section 834 401(e) of the proposed rule includes, without augmentation, the requirements of DOE Order 5400 1 for implementation of a groundwater protection program as documented in a Groundwater Protection Management Program (GPMP). The elements to be included in the management plan are as follows. The plan should

- 1 Address the potential for radiological and, where appropriate, non-radiological contamination of the groundwater by a DOE activity,
- 2 Document the quality and quantity of the groundwater,

- 3 Identify possible sources of contamination,
- 4 Describe strategies for controlling contamination, including preventive and remediation measures to comply with applicable federal environmental laws and regulations, and
- 5 Describe measures for monitoring the groundwater

#### IV. FINDINGS

The required elements of the plan are less inclusive than current DOE Orders (i.e., DOE Order 5400.1) in that they strictly apply only to radioactive materials. However, the plan is to address nonradiological material, "where appropriate." The preamble clarifies this phrase by stating that it is often not appropriate or effective to separate radiological and nonradiological elements in a groundwater protection program. Therefore, to the extent possible, the GPMP should address both

Section 834.401(f) requires development of an Environmental Monitoring Plan that includes, as one component, the groundwater monitoring also required by DOE Order 5400.1. Although the requirement for groundwater monitoring remains intact in the proposed rule, the philosophy behind the monitoring program is now focused on quantifying potential exposures to the public from radioactive materials, and evaluating potential impacts of DOE activities on the public and the environment. The goals set forth in the proposed rule clearly mandate a comprehensive, high quality site-wide monitoring program that takes into account the potential for intermedia transport of contaminants.

The Geosciences Division currently does not have an internal (within EG&G) mechanism to track upcoming regulatory changes that may impact groundwater protection or monitoring requirements. There is a contract in place to provide this service through December 31, 1993. EG&G also has an in-house library which receives various publications which announce regulatory developments, but no one within the Geosciences Division is assigned to track these publications.

## **ADDITIONAL GROUNDWATER CRITERIA COMPLIANCE REVIEW**

### **I. CRITERIA**

32. Do the source control programs at RFP cover all potential sources of groundwater contamination or are there ongoing site operations which are not monitored?

### **II. PRIMARY REGULATORY DRIVERS**

DOE Order 5400 1  
Agreement in Principle

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*Groundwater Protection and Monitoring Program Plan* (EG&G, 1993e)  
*Environmental Management Requirements Manual* (EG&G, no date a)  
*Spill Prevention Control Countermeasures/Best Management Practices Plan* (EG&G, 1992d)  
*EMD Operating Procedures Manual No 5-21000-OPS-GT Volume IV - Surface Water* (EG&G, 1993d)  
*Agreement in Principle* (DOE and State of Colorado, 1989)  
*RCRA Program Description (Draft) 1-10000-EWQA* (EG&G, 1993h)

Interview with Coordinator, Drain Identification Study, EG&G  
Interview with Coordinator, Tank Management Plan, EG&G  
Interview with Group Lead, Surface Water Division Regulatory Permitting and Compliance, EG&G  
Interview with Manager, Underground Storage Tank Program, EG&G  
Interview with Acting Manager, RCRA Regulatory Programs, EG&G  
Interview with Former Manager, RCRA Regulatory Programs, EG&G  
Interview with Performance Assurance Assessor, Transition Standards Identification Program, EG&G  
Interview with Technical Administrator, Transition Standards Identification Program, EG&G  
Interview with Laboratory Coordinator, Surface Water, EG&G  
Interview with Manager, Groundwater Program, EG&G  
Interview with Project Manager, Industrial Area IM/IRA, EG&G  
Interview with Manager, Integrated Operable Unit, EG&G

**Discussion:**

None

**IV. FINDINGS**

A single, unified source control program does not exist at RFP. The extensive individual source control programs that do exist were developed as part of a general environmental protection strategy and are not designed to specifically address groundwater protection. The major source control programs currently in place include:

- 1 The Waste Minimization Program,
- 2 The Chemical Inventory/Chemical Tracking System,
- 3 The *Spill Prevention Control and Countermeasure/Best Management Practices (SPCC/BMPs) Plan*,
- 4 Incidental water control procedures,
- 5 The *Hazardous Waste Requirements Manual*,
- 6 Formation and staffing of a Hazardous Materials Response Team,
- 7 The *Emergency Preparedness Implementation Plan (EPIP)*,
- 8 Operation-specific or project-specific Health and Safety Plans and SOPs,
- 9 Tank Management Plan, and
- 10 Drain Identification Study

These programs are designed to control and respond to spills or other new incidents of contamination after they have occurred, and/or to minimize the potential for spills by eliminating potential contamination sources to the extent possible. These programs are not intended to address inactive waste sites (which are covered under the IAG) or discontinued waste management and production operations.

OU characterization efforts and remedial actions are, in essence, source control activities at inactive waste sites. Ongoing interim remedial actions are being conducted at OUs 1, 2, and 4. Groundwater protection via contaminant source removal is a key component of each of these remedial actions. IHSSs and inactive waste sites which comprise OUs 3, 5, 6, 8 through 10 and 12 through 16 will be remediated, if necessary, according to IAG schedules. According to individual RFI/RI work plans, both sitewide and site-specific groundwater monitoring will be used to identify areas of concern where source control (i.e., remediation) activities are required. Three OUs (4, 7 and 11) are currently classified as active RCRA interim status units scheduled for closure and have site-specific groundwater monitoring requirements. Source control activities at all OUs may be implemented as part of future remediation or closure efforts based on the information obtained from groundwater monitoring activities.

New sources or potential sources of groundwater contamination resulting from facility operations or modifications are generally not accounted for within the Groundwater Monitoring Program. The TSIP has identified that formal written procedures do not currently exist to ensure that future facility operations, such as new construction, closure of existing (active) waste management facilities, and D&D efforts, are coordinated and consistent with the Groundwater Protection Management Program.

The TSIP has also noted that there are no procedures in place to implement groundwater protection and monitoring requirements for existing buildings and operations that are outside the scope of OU investigations. Previous incidents, most notably the incident involving organic chemicals (carbon tetrachloride) in the foundation drain sump of Building 559 and high enriched uranium counts in foundation drain water at Building 886 point to the fact that past operations resulting in UBC are potential sources of groundwater contamination. The sources of UBC, in general, have not been located and monitoring wells adjacent to buildings do not exist to assist with this effort.

With respect to UBC, some water quality information is available from a footing/foundation drain sampling program conducted by the Surface Water Division (SWD). Although this information is incorporated into the RFEDS data base, both the SWD and Geosciences Division confirm that the data are not generally or routinely transmitted to or coordinated with personnel managing the groundwater monitoring program. The ongoing Industrial Area IM/IRA is evaluating future monitoring options for footing drains.

SWD also has a Tank Management Program in progress which is designed to perform integrity assessments and inventory the contents of all above-ground tanks. Approximately 1,500 of an expected 4,000 tanks have been completed. This information would also be useful for evaluating their potential as sources of groundwater contamination, however, as with the footing drains, this information is not coordinated with the groundwater monitoring program.

In addition to the SWD above-ground tank program there is also an Underground Storage Tank (UST) program administered by the RCRA Regulatory Programs Group according to RCRA and UST requirements. Groundwater monitoring is not conducted as part of this program, nor is it required. This program has a limited scope, is specific to hazardous waste and petroleum storage tanks and does not include underground tanks that are considered sanitary waste tanks or strictly radioactive. Approximately 22 active petroleum USTs and approximately 44 inactive hazardous waste USTs have been located. However, only the 22 active petroleum USTs are being managed by the UST program. According to the UST Program Manager, no releases from any of these 22 tanks have been discovered, and all of these tanks are scheduled for replacement or upgrade by 1998. The 44 inactive hazardous waste tanks are scheduled for closure under the IAG and are

therefore not actively managed in the UST program. Non-RCRA USTs (e.g., strictly radioactive) have been located but are also not included in the UST program.

Although some monitoring wells (generally shallow wellpoints) have been installed around specific tanks, these wells were installed for specific purposes unrelated to the sitewide groundwater monitoring program, and well coverage in the vicinity of all USTs is incomplete. It is important to note that groundwater monitoring for active or underground storage tanks is an option but is not required by regulation. Similarly, unless a tank in question is being closed under RCRA closure rules and contamination is expected to remain in place, groundwater monitoring for inactive tanks is also not required.

In summary, source control programs at the RFP are not designed to cover all potential sources of groundwater contamination. These programs generally target ongoing operations and abdicate responsibility for inactive waste sites, previous contamination events, and current and abandoned storage facilities to other programs. None of these other programs are adequately coordinated with the groundwater monitoring program. Formal procedures to evaluate groundwater protection concerns in the conduct of current and future operations are lacking. Characterization and monitoring of under-building contamination is a major deficiency.

## ADDITIONAL GROUNDWATER CRITERIA COMPLIANCE REVIEW

### I. CRITERIA

33. Does RFP have an appropriate management structure and data management systems to ensure implementation of source control programs?

### II. PRIMARY REGULATORY DRIVER

DOE Order 5400 1

### III. BASIS OF OPINION

#### Documents Reviewed and Personnel Interviewed:

*EMD Operating Procedures Manual No 5-21000-OPS-GT Volume I - Field Operations*  
(EG&G, 1993a)

*EMD Operating Procedures Manual No 5-21000-OPS-GT Volume II - Groundwater*  
(EG&G, 1993b)

*EMD Operating Procedures Manual No 5-21000-OPS-GT Volume III - Geotechnical*  
(EG&G, 1993c)

*EMD Operating Procedures Manual No 5-21000-OPS-GT Volume IV - Surface Water*  
(EG&G, 1993d)

Interview with Environmental Sample Tracker, EG&G

Interview with Technical Administrator, Geosciences Division, EG&G

Interview with Supervisor, Operations Technical Support, EG&G

Interview with Manager, Groundwater Program, EG&G

Interview with Project Manager, Industrial Area IM/IRA, EG&G

Interview with Acting Manager, RCRA Regulatory Programs, EG&G

Interview with Group Lead, Surface Water, Regulatory Permitting & Compliance, EG&G

Interview with Coordinator, Surface Water Laboratory, EG&G

Interview with Coordinator, Out-of-Specification Program, EG&G

#### Discussion:

None

#### IV. FINDINGS

As discussed in Criteria No 32, a single, unified source control program does not exist at RFP. Management of individual source control programs and activities is fragmented among various functional organizations. Waste Management operations and the Waste Minimization Program are administratively managed by the Waste Operations/Waste Management organization. Administrative management of the SPCC/BMP Plan, incidental waters program, (above-ground) Tank Management Program, Footing Drain Sampling Program, and Drain Identification Study reside within the Surface Water Division of the Environmental Protection Management (EPM) organization. The Underground Storage Tank Program is managed by the RCRA Regulatory Programs Group of the Waste Management organization. Operable Unit investigations and management of remedial actions are conducted by the Remediation Project Management Division of ERM while management of the sitewide groundwater monitoring program is consolidated in the Environmental Science & Engineering (Geosciences Division) of ERM.

Information on geologic/lithologic features affecting groundwater protection is generally consolidated and managed within the Geosciences Division. The Geosciences Division also coordinates the mapping of contaminant plumes and groundwater potentiometric surfaces. Surface topographic maps, site maps, and construction drawings of facilities (buildings, underground utilities, surface impoundments and ditches, etc.) are maintained by the Facilities Engineering organization.

Data on waste management and/or production operations are generally created and administratively controlled within individual waste management or production groups. These data are loaded into the Waste and Environmental Management System (WEMS) data base to constantly track the generation, volume, and storage location of all waste at RFP. These data are recovered from WEMS, as appropriate, by RCRA Regulatory Programs personnel who then forward them to regulatory agencies in accordance with RCRA and CHWA reporting requirements. These data are generally not readily available to groundwater monitoring program personnel.

Data collected as part of environmental restoration and protection activities are consolidated in the RFEDs. This system is managed by the Data Management Group of ERM but can be accessed, as needed, to support source control programs.

Numerous maps have been generated to cross-reference monitoring well locations with IHSSs, OUs and surface geologic features. No similar mapping was found which documents the relationship between the groundwater monitoring network and waste management operations areas, above-ground and underground tank locations, footing drain or building sump locations, former production operations areas, or current RCRA interim

status treatment and/or storage facility locations, all of which have the potential to impact groundwater

In summary, although it appears that an appropriate management structure exists, and appropriate data management systems are in place, both areas suffer from fragmentation of responsibility and a general lack of coordination among groups. Implementation of source control programs for the protection of groundwater would benefit from additional mapping of activities and facilities having potential impacts on groundwater, and from better communication of groundwater-related information generated by other programs to the Geosciences Division.

## **ADDITIONAL GROUNDWATER CRITERIA COMPLIANCE REVIEW**

### **I CRITERIA**

34. Is there a sitewide data management system with appropriate data entry quality control checks?

### **II. PRIMARY REGULATORY DRIVERS**

None

### **III. BASIS OF OPINION**

#### **Documents Reviewed and Personnel Interviewed:**

*General Radiochemistry and Routine Analytical Services Program Plan (EG&G, 1991c)*

Interview with Manager, Groundwater Program, Geosciences Division, EG&G

Interview with Project Manager, *Well Evaluation Report*, Stoller Corporation

Interview with Data Management Specialist, Stoller Corporation

Interview with Project Staff, Stoller Corporation

Interview with Manager, Sample Management Office, EG&G

#### **Discussion:**

The intent of this question is to determine not just that RFP has an operating data management system, but that this system can produce high quality, accurate data reports to support a wide variety of data users

### **IV. FINDINGS**

Analytical data analyzed by off-site contract labs is managed in RFEDS. This system has evolved from a PC-based spreadsheet to a sophisticated database with 35 distinct information fields. Deficiencies regarding the management of data collected by the groundwater monitoring program fall into the following two categories: (1) A lack of communication between data entry and the intended data users, and (2) problems associated with the format of data that is entered into and extracted from RFEDS.

Many of the formatting problems have been corrected in data entered into RFEDS after September 1992. Recent data users report that the only difficulties with post 1992 data are an occasional result column that contains a zero or is blank. RFP has developed a series of automated routines to check for data entry errors or other unrecognizable codes.

or characters. Laboratories are now required to use a certain list of lab qualifier codes. At the time of data entry, a program automatically checks the data field to identify any codes that are not contained within the specified list. Another automated program checks to ensure that proper and consistent units are reported for each media. Formatting problems with historic (prior to September 1992) data are numerous, and significantly affect the usability of pre-1992 data recovered from RFEDS. These problems are discussed in the specific comments section below.

1 Concern

There is no procedure in place that automatically identifies samples with exceedances. When analytical data are compiled in RFEDS, the responsibilities of the RFP lab protocol group cease. Responsibility for actually examining the data seems to rest entirely with various program managers. It is not hard to build a scenario in which exceedances at a certain location are not noticed immediately, perhaps because of a change in project manager personnel.

Recommendation

Such a situation would not arise if every project were subject to an Out-of-Specification (OOS) procedure similar to that at the four Indiana Street boundary wells, so that exceedances were flagged in a manner that necessarily brings them to the attention of some responsible party. The OOS flagging process should be computer-automated. Situations other than numerical standards exceedances could also be flagged by computer. For example, any water in shallow alluvial wells downgradient of the OU 4 french drain system would be of concern.

2 Concern

Samples subject to OOS reporting must be indicated by a check-mark in the appropriate box on the chain-of-custody form. Checking of the box is performed by the field sampling personnel. It was reported that the check-mark requirement is often overlooked by the field person and the laboratory then does not examine the data for guideline exceedances.

Recommendation

Since problems with OOS reporting are due to human error, it would seem that the procedure could be initiated automatically by computer by using the RFEDS field for well identification as the trigger

3 Concern

At present, there is no formal procedure for informing field teams of QA problems detected in field blanks. Because they were not notified, they potentially could continue to use water for decontamination and QA/QC that has been determined to be unsuitable.

Recommendation

A standard procedure is needed for bringing relevant QA problems to the attention of field teams.

4 Concern

On page 8, section 2.10 of the GRRASP, subcontractors are directed to submit instrument detection limits (IDLs) for each sample. However, this information does not seem to find its way into the RFEDS data base (Exhibit V, page 125).

Recommendation

Since RFEDS data is the form most likely to be used by anyone statistically analyzing lab results, an IDL field should be added to the database. We were told that an IDL field is being required in the new Version 3.0 of GRRASP.

5 Concern

On page 3, Section 2.13 of the GRASSP, subcontractors are directed to submit minimum detectable activities (MDAs) for each sample. However, this information does not get incorporated into the RFEDS data base (Exhibit IV, page 77).

Recommendation

A sitewide decision needs to be articulated regarding the appropriate use of qualified data and unvalidated data

9

Concern

RFEDS contains numerous duplicate records of an individual sample. This duplication arises from several circumstances. Data received from the off-site labs is entered into RFEDS prior to validation by QuantaLex. The same sample sketch is then re-entered after validation by QuantaLex, thereby creating a separate record for the same sample number. Additionally, samples that are reanalyzed after dilution because the calibration curve was exceeded in the first analysis are re-entered as a separate record. In the instance of multiple dilutions, up to four records can exist for a single sample. Although over 30,000 such duplicate records have been purged from the database, many duplicates still exist.

Recommendation

The original unvalidated sample record should be purged at the time that the validated record is entered. A procedure should be developed to clarify use of duplicate records arising from multiple sample dilutions. The process of purging duplicate records should be continued.

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## REFERENCES

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Fiehweg, Robert, Group Leader, Surface Water Division Regulatory Permitting and Compliance, EG&G

Freehling, Mike, Underground Storage Tank Program Coordinator, EG&G

Guillame, Mike, Manager, OU 3, EG&G

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Kantrowitz, Richard, Staff Consultant, QuantaLex.

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Kunkel, Jim, Hydrogeologist, Advanced Sciences, Inc

Levin, Mark, Division Manager, Geosciences Division

Litus, Greg, Former Geologist, EG&G

Lovseth, Tim, Project Manager, Well Abandonment and Replacement Program, EG&G

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Peters, Kyle, Acting Manager, RCRA Regulatory Programs Group, EG&G

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Roberts, Barry, Senior Groundwater Modeler, EG&G

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(C RFP\GW\Referenc)

## ACRONYMS AND ABBREVIATIONS

## ACRONYMS AND ABBREVIATIONS

AGMS	Alternate Groundwater Monitoring System
AIP	Agreement in Principle
ASI	Advanced Sciences, Inc
BMP	Best Management Practice
CDH	Colorado Department of Health
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CHWA	Colorado Hazardous Waste Act
CLP	Contract Laboratory Protocol
COC	Chain of Custody
CWQCA	Colorado Water Quality Control Act
CRDL	Contract-required detection limit
CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DCN	Document Change Notice
DMR	Document Modification Request
DOE	U S Department of Energy
EG&G	EG&G Rocky Flats, Inc
EMD	Environmental Management Division
EPA	Environmental Protection Agency
EPIC	Emergency Preparedness Implementation Plan
EPM	Environmental Protection Management
ERM	Environmental Restoration Management
ERPP	Environmental Radiological Protection Program
FS	Feasibility Study
GAMP	Groundwater Assessment Monitoring Program
GASP	Groundwater Analytical Services Protocol
GMP	Groundwater Monitoring Program
GPMP	Groundwater Protection Management Program
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
GPMP	Groundwater Protection and Monitoring Program Plan
GWMoP	Ground Water Monitoring Plan
GWMP	Ground Water Management Plan
GWR	Great Western Reservoir
HRR	Historical Release Report

IA	Industrial Area
LAG	Interagency Agreement
IDL	Instrument Detection Limit
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IWCP	Integrated Work Control Package
MDA	Minimum Detectable Activity
MSWLF	Municipal solid waste landfill
NRC	Nuclear Regulatory Commission
OOS	Out-of-Specification
OPWL	Original process waste line
OU	Operable Unit
PA	Public Address
PA/SI	Preliminary Assessment/Site Inspection
QA/QC	Quality assurance/quality control
RAD	Radionuclide
RASP	Radioanalytical Services Protocol
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facilities Assessment
RFEDS	Rocky Flats Environmental Database System
RFI	RCRA Facility Investigation
RFP	Rocky Flats Plant
RI	Remedial Investigation
SCS	Soil Conservation Service
SDG	Sample Delivery Group
SDWA	Safe Drinking Water Act
SEO	State Engineer's Office
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control Countermeasures
SWD	Surface Water Division
SWMU	Solid Waste Management Unit

TEGD	Technical Enforcement Guidance Document
TSIP	Transition Standards Identification Program
TM	Technical Memorandum
UBC	Underbuilding contamination
USGS	U S Geological Survey
UST	Underground Storage Tank
U S EPA	U S Environmental Protection Agency
WARP	Well Abandonment and Replacement Program
WAPP	Well Abandonment and Replacement Program Plan
WD	Water Depth
WEMS	Waste and Environmental Management System
WQCC	Water Quality Control Commission
WWE	Wright Water Engineers Inc

931-057 050  
(C:\RPGW\Acronym)

## APPENDIX A

U.S. Department of Energy  
Washington, D.C.

ORDER

DOE 5400.1

11-9-88

SUBJECT: GENERAL ENVIRONMENTAL PROTECTION PROGRAM

Chg 1: 6-29-90

1. PURPOSE. To establish environmental protection program requirements, authorities, and responsibilities for Department of Energy (DOE) operations for assuring compliance with applicable Federal, State and local environmental protection laws and regulations, Executive orders, and internal Department policies. The Order more specifically defines environmental protection requirements that are generally established in DOE 5480.1B.
2. SUPERSESSION. DOE 5480.1A, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION PROGRAM FOR DOE OPERATIONS, of 8-13-81, Chapter XII, Prevention, Control, and Abatement of Environmental Pollution.
3. SCOPE. The provisions of this Order apply to all Departmental elements and contractors performing work for the Department as provided by law and/or contract as implemented by the appropriate contracting officer.
4. REFERENCES.
  - a. DOE Orders.
    - (1) DOE 4300.1B, REAL PROPERTY AND SITE DEVELOPMENT PLANNING, of 7-1-87, which establishes requirements for preparing site development plans for DOE facilities.
    - (2) DOE 4700.1, PROJECT MANAGEMENT SYSTEM, of 3-6-87, which establishes requirements and objectives, and assigns responsibilities and authorities necessary for acquisition of major systems.
    - (3) DOE 5000.3A, OCCURRENCE REPORTING AND PROCESSING OF OPERATIONS INFORMATION, of 5-30-90, which establishes a DOE system for identification, categorization, notification, analysis, reporting, followup, and closeout of occurrences.
    - (4) DOE 5400.2A, ENVIRONMENTAL COMPLIANCE ISSUE COORDINATION, of 1-31-89, which sets forth policy, direction, and procedures for coordinating environmental issues that are of significance to DOE.
    - (5) DOE Orders in the 5400 series dealing with radiation protection of the public and the environment.

Vertical line denotes change.

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- (6) DOE 5440.1C, NATIONAL ENVIRONMENTAL POLICY ACT, of 4-9-85, which establishes DOE policy for implementation of the National Environmental Policy Act of 1969.
- (7) DOE 5480.1B, ENVIRONMENT, SAFETY, AND HEALTH PROGRAM FOR DEPARTMENT OF ENERGY OPERATIONS, of 9-23-86, which outlines environmental protection, safety, and health protection policies and responsibilities.
- (8) DOE 5482.1B, ENVIRONMENT, SAFETY AND HEALTH APPRAISAL PROGRAM, of 9-23-86, which establishes the DOE environmental protection, safety, and health protection appraisal program.
- (9) DOE 5484.1, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION INFORMATION REPORTING REQUIREMENTS, of 2-24-81, which establishes the requirements and procedures for reporting and investigating matters of environmental protection, safety, and health protection significance to DOE operations.
- (10) DOE 5500.1A, EMERGENCY MANAGEMENT SYSTEM, of 2-26-87, which establishes overall policies and requirements for DOE emergency preparedness and response programs.
- (11) DOE 5700.6B, QUALITY ASSURANCE, of 9-23-86, which establishes DOE's quality assurance program.
- (12) DOE 5820.2A, RADIOACTIVE WASTE MANAGEMENT, of 9-26-88, which establishes policies and guidelines for the management of radioactive waste and contaminated facilities.
- (13) DOE 6430.1A, GENERAL DESIGN CRITERIA, of 4-6-89, which provides general design criteria for use in acquisition of DOE facilities.

b. Legislation.

- (1) Title 42 U.S.C. 2011, et seq., The Atomic Energy Act of 1954, as amended, which authorizes the conduct of atomic energy activities.
- (2) Title 42 U.S.C. 7101, et seq., The Department of Energy Organization Act, which establishes the statutory responsibility to ensure incorporation of national environmental protection goals in the formulation of energy programs, and advance the goal of restoring, protection, and enhancing environmental quality, and assuring public health and safety.

Vertical line denotes change.

- (3) Title 42, U.S.C. 4321, et seq., The National Environmental Policy Act of 1969, as amended, which establishes broad national environmental policy.
- (4) Title 42 U.S.C. 7401, et seq., The Clean Air Act, as amended, which provides requirements to protect and enhance the quality of the Nation's air resources to promote the public health and welfare.
- (5) Title 33 U.S.C. 1251, et seq., The Federal Water Pollution Control Act, as amended, which provides requirements to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.
- (6) Title 42 U.S.C. 6901, et seq., Solid Waste Disposal Act of 1965, as amended, which authorizes the U.S. Environmental Protection Agency (EPA) to regulate hazardous and solid wastes.
- (7) Title 40 U.S.C. 9601, et seq., The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, which requires the identification, characterization, and cleanup of inactive hazardous waste sites by responsible parties; and, imposes certain response and reporting requirements for operations from which hazardous substances have been released.
- (8) Title 42 U.S.C. 300, et seq., The Safe Drinking Water Act, as amended, which authorizes EPA to promulgate regulations under two specific programs: the first protects the Nation's public drinking water supplies; the second protects subsurface waters.
- (9) Title 16 U.S.C. 1451, et seq., The Coastal Zone Management Act of 1972, as amended, which establishes and supports national coastal zone management policies.
- (10) Title 16 U.S.C. 1531, et seq., The Endangered Species Act of 1973, as amended, which establishes a program for the conservation of endangered species and their ecosystems.
- (11) Title 16 U.S.C. 661, et seq., The Fish and Wildlife Coordination Act, as amended, which authorizes the Secretary of the Interior to provide assistance to and cooperate with public and private organizations in the development and protection of the Nation's fish and wildlife.

- (12) Title 16 U.S.C. 470, et seq., The National Historic Preservation Act of 1966, as amended, which establishes the policy of the U.S. Government to protect and preserve historical structures, sites and artifacts.
- (13) Title 15 U.S.C. 2601, et seq., Toxic Substances Control Act, as amended, which provides requirements to safely regulate the manufacture, processing, distribution in commerce, use or disposal of chemical substances and mixtures which may present an unreasonable risk to either the public health or the environment.
- (14) Title 42 U.S.C. 1996, et seq., The American Indian Religious Freedom Act, as amended, which establishes a policy of the U.S. Government to protect and preserve for American Indians their inherent right of freedom of religion, including access to sites
- (15) Title 7 U.S.C. 136, et seq., The Federal Insecticide, Fungicide, and Rodenticide Act, as amended, which authorizes EPA to promulgate regulations governing the use and disposal of pesticides.
- (16) Title 42 U.S.C. 4901, et seq., The Noise Control Act of 1972, as amended, which establishes a means for coordination of Federal noise control research, setting noise emission standards, and providing information to the general public.
- (17) Title 33 U.S.C. 1412, et seq., The Marine Protection, Research, and Sanctuaries Act, as amended, which regulates the dumping of materials into ocean waters.
- (18) Title 16 U.S.C. 1273, et seq., The Wild and Scenic Rivers Act, as amended, which establishes a national wild and scenic rivers system to preserve and protect selected rivers of the Nation.
- (19) Title 42 U.S.C. 10101, et seq., The Nuclear Waste Policy Act of 1982, as amended, which provides for the development of repositories for the disposal of high-level radioactive waste and spent fuel, and to establish a program of research, development, and demonstration regarding the disposal of high-level radioactive waste and spent nuclear fuel.

- (20) Title 42 U.S.C. 2021, et. seq., The Low-Level Radioactive Waste Policy Act, as amended, which establishes procedures for the implementation of compacts providing for the establishment and operation of regional disposal facilities for low-level radioactive waste.
- (21) Title 42 U.S.C. 7901, et. seq., The Uranium Mill Tailings Radiation Control Act of 1978, as amended, which provides for a remedial action program at selected inactive uranium mill tailings sites.
- (22) Title 42 U.S.C. 7158 Note, The Department of Defense Authorization Act of 1985, which statutorily prescribes Executive order 12344.

c. Executive Orders.

- (1) Executive order 12088, "Federal Compliance with Pollution Control Standards," of 10-13-78, which requires that all Federal facilities and activities comply with applicable pollution control standards.
- (2) Executive order 12344, "Naval Nuclear Propulsion Program," of 2-1-82, which establishes an integrated Naval Nuclear Propulsion Program to be carried out by two organizational units, one in the U.S. Department of the Navy and one in the U.S. Department of Energy.
- (3) Executive order 12580, "Superfund Implementation," of 1-23-87, which delegates to various federal officials the responsibilities vested in the President for implementing the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). [The Order delegates most of these responsibilities to the Administrator of the Environmental Protection Agency (EPA), but several are delegated to the heads of Federal agencies, including DOE.]
- (4) Office of Management and Budget (OMB) Circular No. A-106, "Reporting Requirements in Connection with the Prevention, Control, and Abatement of Environmental Pollution of Existing Federal Facilities," of 12-31-74.

d. Applicable State and Local Legislation and Regulations in Which DOE Operations are Located.

e. Other.

- (1) DOE's "Final Guidelines for Compliance with the National Environmental Policy Act," 52 FR 47662, of 12-15-87, and subsequent amendments, which establish final guidelines for implementing the procedural provisions of the National Environmental Policy Act as required by the Council on Environmental Quality regulations.

5. POLICY.

- a. It is DOE policy to conduct its operations in an environmentally safe and sound manner. Protection of the environment and the public are responsibilities of paramount importance and concern to DOE. All DOE activities should recognize and reflect this concern and public trust. To that end, DOE is firmly committed to ensuring incorporation of national environmental protection goals in the formulation and implementation of DOE programs. It has an equal commitment to advance the goals of restoring and enhancing environmental quality, and ensuring public health. Accordingly, it is DOE policy to conduct the Department's operations in compliance with the letter and spirit of applicable environmental statutes, regulations, and standards. In addition, DOE is committed to good environmental management of all its programs and at all its facilities to correct existing environmental problems, to minimize risks to the environment or public health, and to anticipate and address potential environmental problems before they pose a threat to the quality of the environment or the public welfare. Finally, it is DOE's policy that efforts to meet environmental obligations be carried out consistently across all operations and among all field organizations and programs.
- b. While responsibility for good environmental management is a Departmental one, environmental protection practices will, of necessity, be carried out at the levels and locations where many DOE activities are performed by its management and operating contractors. Thus, although the Department will continue to indemnify its management and operating contractors for fines, penalties, and other liabilities that are incurred pursuant to their contracts and not the result of willful misconduct or lack of good faith, it is DOE policy that contractors will share the Department's commitment to good environmental management. DOE expects its management and operating contractors to conduct their operations in an environmentally sound manner that limits the risks to the environment and protects the public health. DOE will actively oversee contractors' activities to assure compliance with this policy.

6. APPLICABILITY.

- a. In recognition of the environmental significance of Departmental activities authorized by the Atomic Energy Act (AEA), this Order addresses and, of necessity, emphasizes requirements for radiation protection. It also is written to reflect the DOE organizational structure for operations that implement AEA activities. It is understood and expected that other DOE elements, e.g., power marketing administrations, will design and manage their environmental protection programs in such a manner so as to be equivalent to requirements contained in this Order and in compliance with applicable statutes and regulations.
- b. Environmental management activities of DOE are extensively, but not entirely, regulated by EPA, State, and local environmental agencies. Where these agencies clearly exercise environmental protection authority through permitting and compliance administrative procedures applicable to DOE, they establish and regulate required performance for environmental protection. This Order and other DOE environmental protection directives provide requirements for satisfying these externally imposed regulations. Additionally, these directives establish requirements for those environmental protection programs that are not externally regulated, but require internal management consistent with DOE Orders that provide specific, detailed requirements in selected areas of environmental protection.
- c. Inasmuch as this directive for the most part serves to implement legislatively mandated requirements, it is expected that activities, documentation, and special planning conducted to meet these legal requirements will be used to the maximum extent to satisfy requirements of this Order.

7. LEGISLATIVE AUTHORITY. The Department of Energy Organization Act of 1977 and the Atomic Energy Act of 1954, as amended, provide for, among other things, the protection of the health and safety of the public and the environment in the conduct of the Department's programs.

8. DEFINITIONS.

- a. DOE Operations, for the purposes of this Order, are those DOE managed, directed, or funded activities for which the Department has responsibility for Environment, Safety and Health (ES&H).
- b. Effluent is any treated or untreated air emission or liquid discharge at a DOE site or from a DOE facility.

- c. Environmental Monitoring is the collection and analysis of samples or direct measurements of environmental media. Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance.
- d. Environmental Protection Standard is a specified set of rules or conditions concerned with: delineation of procedures; definition of terms; specification of performance, design, or operations; or measurements that define the quantity of emissions, discharges, or releases to the environment and the quality of the environment.
- e. Effluent Monitoring is the collection and analysis of samples, or measurements of liquid and gaseous effluents for the purpose of characterizing and quantifying contaminants, assessing radiation exposures of members of the public, providing a means to control effluents at or near the point of discharge, and demonstrating compliance with applicable standards and permit requirements.
- f. Environmental Surveillance is the collection and analysis of samples, or direct measurements, of air, water, soil, foodstuff, biota, and other media from DOE sites and their environs for the purpose of determining compliance with applicable standards and permit requirements, assessing radiation exposures of members of the public and assessing the effects, if any, on the local environment.
- g. Environmental Occurrence is any sudden or sustained deviation from a regulated or planned performance at a DOE operation that has environmental protection and compliance significance.
- h. DOE Contractor includes any prime contractor or subcontractor subject to the contractual provisions of 48 CFR Part 923.70, 48 CFR Part 970.23, or other contractual provisions where DOE has elected to enforce ES&H requirements by specific negotiated contract provisions.
- i. Field Organization is the first line DOE field element that carries the organizational responsibility for (1) managing and executing assigned programs, (2) directing contractors who conduct the programs, and (3) assuring that environment, safety, and health are integral parts of each program.
- j. Program Senior Official (PSO) is a senior outlay program manager and includes the Assistant Secretaries for Conservation and Renewable Energy, Defense Programs, Fossil Energy, and Nuclear Energy, the Director of Energy Research, and the Director of Civilian Radioactive Waste Management. For purposes of this Order, this definition also includes the Administrators of the Bonneville and Western Area Power Administrations

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9. RESPONSIBILITIES AND AUTHORITIES. The following responsibilities and authorities, as well as those contained in DOE 5480.1B, are assigned.
- a. The Deputy Secretary (S-2) has overall responsibility and authority for DOE programs and may take necessary management actions to ensure safety, including directing the curtailment and suspension of operations, when in his or her opinion, such operation would result in undue risk.
  - b. The Assistant Secretary for Environment, Safety and Health (EH-1) shall:
    - (1) Establish environmental protection policies, guidance, requirements, and procedures for DOE operations.
    - (2) Provide the central point for coordination among PSOs and field organizations, and interact with other agencies and groups in:
      - (a) The development of internal DOE environmental protection policy, guidance, and directives;
      - (b) The development of environmental protection regulations, standards, and requirements by Federal and State regulatory agencies; and
      - (c) The review and comment on proposed environmental legislation and regulation that may affect DOE operations.
    - (3) Conduct the environmental survey program and follow-on audits of line organizations in accordance with DOE 5482.1B and other environmental requirements.
    - (4) Direct the DOE National Environmental Policy Act program, approve and concur in Departmental Environmental Impact Statements and other NEPA documents, and assure Departmental compliance with NEPA in accordance with DOE 5440.1C.
    - (5) Develop environmental compliance policies, requirements, and procedures for DOE operations including notification and reporting of significant environmental occurrences.
    - (6) Coordinate the timely review, resolution, and dissemination of significant environmental compliance issues (which are to be included in permit applications, settlement agreements, consent decrees and Orders, and lawsuits) and related activities for the Department with the Office of the General Counsel, affected PSOs and field organizations, in accordance with DOE 5400.2.

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- (7) Develop and maintain systems for collection, retention, evaluation and dissemination of information that characterizes DOE environmental management and demonstrates compliance with environmental protection laws and regulations.
- (8) Coordinate, prepare, and submit pollution abatement plans and progress reports to the Environmental Protection Agency in accordance with Executive order 12088 and OMB Circular A-106.
- (9) Review and concur in program and project direction guidance issued by a PSO related to environmental protection matters that affect more than one field organization or that have environmental policy implications.
- (10) Curtail or suspend operations at DOE facilities, under the conditions described below, when a clear and present danger exists to workers or members of the public, as provided in DOE Order 5480.1B. (Clear and present danger is a condition or hazard which could reasonably be expected to cause death or serious harm to plant workers or the public immediately or before such condition or hazard can be eliminated through normal procedures.)
  - (a) Whenever EH-1, in carrying out his or her responsibilities, determines that the environmental, safety, or health conditions at any DOE facility present a clear and present danger, EH-1 shall notify the Deputy Secretary that such a determination has been made. In addition, notification shall be provided to the PSO and the Head of the appropriate field organization. Upon receiving such notification, the Head of the Field Organization shall take immediate action to curtail or suspend the operation and mitigate the danger.
  - (b) If appropriate action is not taken to curtail or suspend the operation and mitigate the identified danger, EH-1 shall advise the Secretary. In the event that the Secretary is unavailable, EH-1 is authorized to direct the PSO or field organization to suspend or curtail an operation which EH-1 has determined is posing a clear and present danger until the danger has been mitigated.
  - (c) The authority reflected in subparagraph (11) may not be redelegated or assumed by acting officials and will terminate on 1-31-89, unless specifically renewed.

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- (11) Issue guidance in cooperation with PSOs to field organizations for the preparation of long range environmental protection plans; review those plans upon submission by field organizations; coordinate the development of a DOE-wide long range environmental protection plan.

c. Program Senior Officials (PSOs) shall:

- (1) Provide clear and explicit delegations of authority and responsibilities for implementing DOE environmental protection programs.
- (2) Ensure that appropriate environmental requirements are included in program plans.
- (3) Advise EH-1, in a timely manner, of significant programmatic environmental issues requiring resolution.
- (4) Concur in significant environmental compliance issues, such as compliance agreements and consent orders which may affect programs or projects under his or her jurisdiction.
- (5) In consultation with EH-1, provide environmental protection direction to field organizations consistent with Departmental Orders and policies.
- (6) Provide oversight and, as appropriate, verify field organization compliance with any environmental guidance provided by the PSO.
- (7) Assure that program budget proposals include provisions to comply with environmental protection requirements that are consistent with programs and projects identified in the OMB Circular A-106 pollution plans and, as required by DOE 5480.1B, take appropriate management actions to include adequate ES&H resources for assigned functions in budget proposals that incorporate results of the ES&H upgrade project ranking process.
- (8) Participate with, and support EH-1 in preparing and coordinating Departmental comments on emerging environmental regulations and policies of other agencies that may affect DOE operations.
- (9) Participate in selected environmental appraisals, surveys, and audits as described in DOE 5482.1B.

- (10) Direct Heads of Field Organizations to curtail or suspend operations when any activity presents a clear and present danger to workers, members of the public, or the environment, as provided in DOE 5480.1B, page 10, paragraph 8(c)(20).
- (11) Provide EH-1 with environmental information and documentation upon request.
- (12) Support EH-1 in issuing guidance for the preparation of long range environmental protection plans; review those plans upon submission by field organizations; coordinate with EH-1 in the development by EH-1 of a DOE-wide long range environmental protection plan.

d. The General Counsel shall:

- (1) Provide advice and assistance to EH-1 and other DOE elements in support of DOE environmental protection programs and compliance activities.
- (2) Provide prompt advice and assistance to EH-1 in resolving environmental compliance issues and related activities within his or her area of responsibility (e.g., consent decrees and consent administrative orders).
- (3) Provide advice and assistance to EH-1 and other DOE program elements in preparing departmental comments on emerging environmental regulations and policies that may affect DOE operations.
- (4) Advise EH-1 and other DOE program elements on Departmental environmental impact statements and other NEPA documents.
- (5) Coordinate DOE environmental litigation activities and represent DOE at the Department of Justice on these activities.

e. Assistant Secretary, Management and Administration (MA-1) shall review long range environmental protection plans prepared by Heads of Field Organizations; and support the development of a DOE-wide long range environmental protection plan.

f. Heads of Field Organizations shall:

- (1) Issue and update, as required, a general environmental statement that reflects the statement of policy in this Order and contains broad environmental protection goals for all facilities and activities for which he or she is responsible

- (2) Ensure that all operations under their authority comply with applicable environmental protection laws and regulations, and directives.
- (3) Identify significant environmental compliance issues that require resolution and coordination, and advise EH-1 and Headquarters program elements in a timely manner.
- (4) Ensure that all required environmental permits are secured from the appropriate regulatory agency in a timely fashion. Consistent with the requirements of DOE 5400.2, in negotiating the terms and conditions of permits, settlements, consent orders, consent decrees, or other legal or administrative documents, every effort shall be made to assure that permit requirements and conditions reflect the requirements of environmental regulations, consistent with national security interests, and are cost-effective.
- (5) Conduct environmental appraisals of programs, projects, and facilities in accordance with DOE 5482.1B, and other ES&H requirements, and provide copies of appraisal reports to EH-1 and the appropriate program office.
- (6) Establish and maintain liaison and cooperative programs with appropriate Federal, Regional, State, and local environmental officials so as to facilitate effective environmental management.
- (7) Develop and implement programs that direct contractors to execute environmental protection compliance programs and policies, and provide for oversight, confirmation, and independent verification of those contractor programs.
- (8) Prepare long range environmental protection plans in accordance with guidance issued by EH-1.
- (9) Ensure that budget requests provide for required environmental protection upgrades and corrective action, that they are timely, and are consistent with pollution abatement plans prepared as required by OMB Circular A-106.
- (10) Prepare biannual pollution abatement plans required by OMB Circular A-106 and submit to EH-1 on a schedule provided by that office.
- (11) Provide EH-1 all environmental information and documentation that is requested

- (12) Curtail or suspend any operation that poses a clear and present danger to members of the public or the environment.
  - (13) Provide for community public information and education programs concerning DOE environmental protection programs, consistent with the requirements of environmental regulations and national security interests.
- g. Director, Naval Nuclear Propulsion Program: Executive Order 12344, statutorily prescribed by P.L. 98-525 (42 USC 7158 note), establishes the responsibilities and authority of the Director, Naval Nuclear Propulsion Program (who is also the Deputy Assistant Secretary for Naval Reactors within the Department) over all facilities and activities which comprise the Program, a joint Navy-DOE organization. The policy principle promoted by these executive and legislative actions is cited in the Executive Order as "... preserving the basic structure, policies, and practices developed for this Program in the past ...". Accordingly, based on the Executive Order and this policy principle, the Naval Nuclear Propulsion Program is exempt from the provisions of this Order. The Director shall maintain an environmental protection program to assure compliance with applicable environmental statutes and regulations. The Director and EH-1 shall cooperatively develop information exchange and other mutually beneficial programs as appropriate, consistent with P.L. 98-525.

BY ORDER OF THE SECRETARY OF ENERGY:



JOSEPH F. SALGADO  
Deputy Secretary

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CHAPTER IENVIRONMENTAL PROTECTION STANDARDS

1. PURPOSE. To provide the mandatory environmental standards that are in effect at DOE operations and procedural guidance for securing an exemption from a standard.
2. ENVIRONMENTAL PROTECTION STANDARD. See definition at page-8, subparagraph 8d.
3. STANDARDS. Environmental protection standards fall into three categories.
  - a. Those imposed by Federal statutes, regulations, and requirements. (The major federal environmental protection standards that apply to DOE operations are contained in the listing in Attachment I-1.)
  - b. Those imposed by State and local statutes, regulations, and requirements which are applicable to DOE.
  - c. Those imposed by DOE directives.
4. EXEMPTION PROCEDURES. Requests for exemptions from applicable environmental protection standards are not encouraged. However, in limited cases, programmatic circumstances or operational conditions may warrant such requests in accord with the following procedures.
  - a. From Federal, State and Local Regulations.
    - (1) Specific procedures for processing exemptions to standards are contained in Federal, State, and local laws and regulations. To the extent that Federal, State, and local laws and regulations allow for an exemption from any standard, field organizations and  
• PSOs, as appropriate, are to use applicable administrative and legal procedures to secure approval for any exemption. EH-1 will provide technical and administrative support to any organization upon request. In the case of generic issues that affect department-wide compliance with environmental standards, EH-1 will coordinate efforts to obtain agreements from the regulatory authority for a DOE-wide exemption. Heads of Field Organizations and PSOs, as appropriate, shall submit to EH-1, the General Counsel, and the appropriate Program Senior Official(s) information copies of all requests to Federal or State agencies for exemptions.

- (2) The field organization and PSOs, as appropriate, shall take the lead role in coordinating the exemption request with the appropriate Federal, State, or local agency responsible for the enforcement of the standard for which the exemption is being requested.
- (3) After a determination has been made by the appropriate Federal, State, or local agency, the field organization and PSOs, as appropriate, shall notify EH-1, the General Counsel, and the appropriate PSOs of the disposition of the request.

b. From Internal DOE Environmental Standards. Procedures for exemptions from standards which are internally imposed as a matter of DOE policy are as follows:

(1) Temporary Exemptions.

- (a) Heads of Field Organizations and PSOs, as appropriate, shall submit to EH-1, with copies to the appropriate Program Senior Official(s), a request for a temporary exemption from DOE mandatory standards. A request for a temporary exemption shall contain the following:
  - 1 A specification of the standard from which the field organization or PSO seeks an exemption;
  - 2 Detailed statements of why the field organization or PSO is unable to comply with the standard;
  - 3 A statement of the steps taken or to be taken to minimize the risk to the public and environment, including the conditions the field organization or PSO shall maintain and the means, methods, operations, and processes which shall be adopted and used;
  - 4 An analysis of the benefits to be gained from the exemption and the negative impact on the program or activity if not granted, compared with the risk posed by conducting the activity under the exemption; and
  - 5 A statement of when the field organization or PSO will be able to comply with the standard and what steps have been and will be taken by the field organization to come into compliance with the standard.

- (b) EH-1 shall review the field organization's or PSO's request within 60 days of receipt of the request. After review and evaluation of the request and recommendations from the appropriate PSO, EH-1 shall approve a temporary exemption if the request establishes that the field organization or PSO:
- 1 Is unable to comply with the standard because of unavailability of funding, professional or technical personnel, materials or equipment, or because necessary construction or alteration of facilities must be completed to comply;
  - 2 Is taking all available steps to provide environment and health protection; and,
  - 3 Has an effective program for coming into compliance with the standard as quickly as possible.
- (c) A temporary exemption may be in effect for the period needed by the field organization or PSO to achieve compliance with the standard, but no longer than 2 years, except that in unusual circumstances (e.g., lack of programmatic funding), a temporary exemption may be renewed for a 1-year period. An application for renewal must be filed and processed in the same manner specified in subparagraphs 4b(1)(a) and 4b(1)(b); this shall be done at least 90 days prior to expiration of the temporary exemption.
- (2) Permanent Exemptions. In limited cases, EH-1 may approve a permanent exemption if the field organization or PSO has demonstrated that the conditions, practices, means, methods, operations, or processes to be used will provide environment, safety, and health protection which is comparable to that which would prevail if the field organization or PSO had complied with the standard. Heads of Field Organizations or PSOs shall submit to EH-1 any request for a permanent exemption from DOE standards. The request for exemption shall contain all applicable information specified in subparagraph 4b(1)(a). Within 60 days of the receipt of the request, EH-1 shall review and evaluate the request and recommendations from the appropriate PSO.
- (3) Field-Level Exemptions. The Head of the Field Organization or PSO may grant field-level exemptions from mandatory standards during the period of time in which the request for a temporary or permanent exemption is being processed by Headquarters. A field-level exemption shall be granted where the Head of the Field Organization or PSO has sufficient assurance that the

environmental and health risks are acceptably low. The field-level exemption is to be effective until a decision on the issuance of an exemption is made by EH-1.

- c. Presidential Exemption. Any request for a Presidential exemption from applicable pollution control standards shall comply with the procedures prescribed in Section 1-7 of Executive order 12088. The request should be forwarded to EH-1 with copies to the appropriate PSO. Recommendations for Presidential exemptions will be developed by EH-1, concurred in by GC and the PSO, and transmitted to the Office of Management and Budget under the Secretary's signature. Presidential exemptions may be requested under the following Acts, inter alia.

- (1) Clean Air Act, as amended, Section 118(b).
- (2) Clean Water Act, as amended, Section 313(a).
- (3) Safe Drinking Water Act, as amended, Section 1447(b).
- (4) Resource Conservation and Recovery Act, as amended, Section 6001.
- (5) Comprehensive Environmental Response, Compensation, and Liability Act, as amended, Section 120(j)(1).
- (6) Noise Control Act, as amended, Section 4(b)(2).

## MANDATORY ENVIRONMENTAL PROTECTION STANDARDS

To the extent legally applicable to a particular activity, standards contained in the following legislation, regulations, and Executive orders are mandatory for DOE Operations. This Appendix includes certain major federal requirements, but is not necessarily all-inclusive. Specific standards - including state and local requirements - applicable to individual activities should be determined on a site-specific basis.

### 1. EXECUTIVE ORDERS (E.O.)

- a E.O. 11987, "Exotic Organisms."
- b E.O. 11988, "Floodplain Management."
- c E.O. 11989, "Off-Road Vehicles on Public Lands "
- d E.O. 11990, "Protection of Wetlands."
- e E.O. 11514 and E.O. 11991, "Protection and Enhancement of Environmental Quality."
- f E.O. 11593, "Protection and Enhancement of Cultural Environment."
- g E.O. 12088, "Federal Compliance with Pollution Control Standards."
- h E.O. 12146, "Management of Federal Legal Resources."
- i E.O. 12316, "Response to Environmental Damage."
- j E.O. 12342, "Environmental Safeguards on Activities for Animal Damage Control on Federal Lands."
- k E.O. 12344, "Naval Nuclear Propulsion Program."
- l E.O. 12580, "Superfund Implementation."

### 2 THE NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED.

- a Title 36 CFR Part 800, "Protection of Historic and Cultural Properties."
- b Title 43 CFR Part 7, "Protection of Archaeological Resources "

3. TITLE 42 U.S.C. 7401, ET SEQ., THE CLEAN AIR ACT, AS AMENDED.

- a. Title 40 CFR Part 50, "National Primary and Secondary Ambient Air Quality Standards."
- b. Title 40 CFR Part 52, "Approval and Promulgation of Implementation Plans."
- c. Title 40 CFR Part 53, "Ambient Air Monitoring Reference and Equivalent Methods."
- d. Title 40 CFR Part 58, "Ambient Air Quality Surveillance."
- e. Title 40 CFR Part 60, "Standards of Performance for New Stationary Sources."
- f. Title 40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants."
- g. Title 40 CFR Part 65, "Delayed Compliance Orders."
- h. Title 40 CFR Part 66, "Assessment and Collection of Noncompliance Penalties by EPA."
- i. Title 40 CFR Part 69, "Special Exemptions from Requirements of the Clean Air Act."
- j. Title 40 CFR Part 81, "Designation of Areas for Air Quality Planning Purpose."

4. TITLE 33 U.S.C. 1251 ET SEQ., THE CLEAN WATER ACT, AS AMENDED.

- a. Title 33 CFR Parts 153-157, "Control of Pollution by Oil and Hazardous Substances."
- b. Title 33 CFR Part 159, "Marine Sanitation Devices."
- c. Title 33 Parts 320, 322-329, "Permit Programs Regulations."
- d. Title 40 CFR Part 109, "Criteria for State, Local and Regional Oil Removal Contingency Plans."
- e. Title 40 CFR Part 110, "Discharge of Oil."
- f. Title 40 CFR Part 112, "Oil Pollution Prevention."
- g. Title 40 CFR Part 113, "Liability Limits for Small Onshore Storage Facilities."

- h. Title 40 CFR Part 114, "Civil Penalties for Violation of Oil Pollution Prevention Regulations."
- i. Title 40 CFR Part 116, "Designation of Hazardous Substances."
- j. Title 40 CFR Part 117, "Determination of Reportable Quantities for Hazardous Substances."
- k. Title 40 CFR Part 121, "State Certification of Activities Requiring a Federal License or Permit."
- l. Title 40 CFR Part 122, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System."
- m. Title 40 CFR Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System."
- n. Title 40 CFR Part 129, "Toxic Pollutant Effluent Standards."
- o. Title 40 CFR Part 131, "Water Quality Standards."
- p. Title 40 CFR Part 133, "Secondary Treatment Regulation."
- q. Title 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants."
- r. Title 40 CFR Part 140, "Marine Sanitation Device Standard."
- s. Title 40 CFR Parts 220-225, 227-229, "Ocean Dumping Regulations and Criteria."
- t. Title 40 CFR Part 230, "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material."
- u. Title 40 CFR Part 231, "Section 404(c) Procedures."
- v. Title 40 CFR Part 401, "General Provisions for Effluent Guidelines and Standards" (Note: Title 40 CFR Part Section 401.14, "Cooling Water Intake Structures").
- w. Title 40 CFR Part 403, "General Pretreatment Regulations for Existing and New Sources of Pollution."
- x. Title 40 CFR Part 413, "Electroplating Point Source Category."
- y. Title 40 CFR Part 423, "Steam Electric Power Generating Point Source Category."

2. Title 40 CFR Part 457, "Explosives Manufacturing Point Source Category."

aa. Title 40 CFR Part 459, "Photographic Point Source Category."

5. TITLE 42 U.S.C. 300 F. ET SEQ., THE SAFE DRINKING WATER ACT, AS AMENDED.

a. Title 40 CFR Part 141, "National [Interim] Primary Drinking Water Regulations."

b. Title 40 CFR Part 142, "National Primary Drinking Water Regulations Implementation."

c. Title 40 CFR Part 143, "National Secondary Drinking Water Regulations."

d. Title 40 CFR Part 144, "Underground Injection Control Program."

e. Title 40 CFR Part 146, "Underground Injection Control Program: Criteria and Standards."

f. Title 40 CFR Part 147, "State Underground Injection Control Programs."

g. Title 40 CFR Part 149, "Sole Source Aquifers."

6. TITLE 16 U.S.C. 1451, ET SEQ., THE COASTAL ZONE MANAGEMENT ACT OF 1972, AS AMENDED.

a. Title 15 CFR Part 921, "NOAA Guidelines on Estuarine Sanctuaries."

b. Title 15 CFR Part 923, "NOAA Coastal Zone Management Program Approval Regulations."

c. Title 15 CFR Part 930, "NOAA Regulations on Federal Consistency with Approved Coastal Management Program."

d. Title 15 CFR Part 931, "NOAA Regulations on Coastal Energy Impact Program."

7. RADIATION PROTECTION.

a. Title 10 CFR Part 712, "Grand Junction Remedial Action Criteria."

b. Title 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

c. Title 40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes."

- d. Title 40 CFR Part 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings."
- 8. TITLE 42 U.S.C. 9601 [9615] ET SEQ., THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980, AS AMENDED.
  - a. Title 40 CFR Part 300, "National Oil and Hazardous Substances Pollution Contingency Plan."
  - b. Title 40 CFR Part 302, "Designation, Reportable Quantities, and Notification."
  - c. Title 40 CFR Part 305, "Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Arbitration Procedures."
  - d. Title 40 CFR Part 306, "Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Natural Resources Claims Procedures."
  - e. Title 43 CFR Part 11, "Natural Resource Damage Assessments."
- 9. TITLE 7 U.S.C. 136, ET SEQ., THE FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT, AS AMENDED.
  - a. Title 40 CFR Part 162, "Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act."
  - b. Title 40 CFR Part 165, "Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticides Containers."
  - c. Title 40 CFR Part 166, "Exemption of Federal and State Agencies for Use of Pesticides Under Emergency Conditions."
  - d. Title 40 CFR Part 170, "Worker Protection Standards for Agricultural Pesticides."
  - e. Title 40 CFR Part 171, "Certification of Pesticide Applicators."
- 10. TITLE 42 U.S.C. 6901, ET SEQ., THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976, AS AMENDED.
  - a. Title 40 CFR Part 240, "Guidelines for the Thermal Processing of Solid Wastes"
  - b. Title 40 CFR Part 241, "Guidelines for the Land Disposal of Solid Wastes"

- c. Title 40 CFR Part 243, "Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste."
- d. Title 40 CFR Part 244, "Solid Waste Management Guidelines for Beverage Containers."
- e. Title 40 CFR Part 245, "Promulgation Resource Recovery Facilities Guidelines."
- f. Title 40 CFR Part 246, "Source Separation for Materials Recovery Guidelines."
- g. Title 40 CFR Part 247, "Guidelines for Procurement of Products that Contain Recycled Material."
- h. Title 40 CFR Part 256, "Guidelines for Development and Implementation of State Solid Waste Management Plans."
- i. Title 40 CFR Part 257, "Criteria for Classification of Solid Waste Disposal Facilities and Practices."
- j. Title 40 CFR Part 260, "Hazardous Waste Management System: General."
- k. Title 40 CFR Part 261, "Identification and Listing of Hazardous Waste."
- l. Title 40 CFR Part 262, "Standards Applicable to Generators of Hazardous Waste."
- m. Title 40 CFR Part 263, "Standards Applicable to Transporters of Hazardous Waste."
- n. Title 40 CFR Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities."
- o. Title 40 CFR Part 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities."
- p. Title 40 CFR Part 266, "Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities."
- q. Title 40 CFR Part 267, "Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities."
- r. Title 40 CFR Part 268, "Land Disposal Restrictions."

- s. Title 40 CFR Part 270, "EPA Administered Permit Programs: The Hazardous Waste Permit Program."
  - t. Title 40 CFR Part 272, "Approved State Hazardous Waste Management Programs."
  - u. Title 40 CFR Part 280, "Underground Storage Tanks."
11. TITLE 16 U.S.C. 1531, ET SEQ., THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, TITLE 50 CFR PART 17, "FISH AND WILDLIFE SERVICE LIST OF ENDANGERED AND THREATENED WILDLIFE AND PLANTS".
  12. TITLE 15 U.S.C., ET SEQ., THE TOXIC SUBSTANCES CONTROL ACT, AS AMENDED, TITLE 40 CFR PART 761, "POLYCHLORINATED BIPHENYLS (PCBs) MANUFACTURING, PROCESSING, DISTRIBUTION IN COMMERCE, AND USE PROHIBITIONS".
  13. TITLE 42 U.S.C. 4901, ET SEQ., THE NOISE CONTROL ACT OF 1972, AS AMENDED.
  14. TITLE 16 U.S.C. 1131, ET SEQ., THE WILDERNESS ACT, AS AMENDED, TITLE 43 CFR PART 19, "WILDERNESS PRESERVATION".

CHAPTER II  
NOTIFICATION AND REPORTS

1. **PURPOSE.** To establish requirements for: (a) notification and followup of environmental occurrences; and, (b) periodic routine reporting of significant environmental protection information. Each DOE facility is unique; thus, notification and reporting requirements shall be determined by the Head of Field Organizations on a case-by-case basis, consistent with regulatory requirements and DOE directives.
2. **NOTIFICATION OF ENVIRONMENTAL OCCURRENCES.**
  - a. Consistent with the notification requirements contained in DOE 5484.1 and DOE 5000.3A, and the DOE orders in the 5500 series dealing with emergency management, field organizations and DOE contractors shall notify the Headquarters Emergency Operations Center (EOC) of the significant nonroutine release of any pollutant or hazardous substance, e.g., releases of hazardous substances that are reported to the Environmental Protection Agency National Response Center as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Notification to the EOC shall be concurrent with notification to any regulatory agencies. Where applicable, existing reporting formats should be used. A written report of followup and resolution of any reported environmental occurrence which has environmental significance shall be prepared in accordance with the requirements of DOE 5484.1 and DOE 5000.3A.
  - b. Field organizations shall maintain documentation of responses to environmental occurrences and have them available for regulatory agency inspectors, DOE auditors, and the general public. Field organizations shall prepare annual summary reports on environmental occurrence activities. This information shall be included in Annual Site Environmental Reports.
3. **OFFICE OF MANAGEMENT AND BUDGET CIRCULAR A-106.** Departmental pollution abatement projects shall be reported in a 5-year plan as required by Office of Management and Budget (OMB) Circular A-106, and EPA and DOE guidance issued thereto. Field Organizations shall submit their reports semiannually to EH-1 on dates determined by EH-1, but in any event no later than May 1 and December 15 of each year. Confirmatory reports are to be submitted by line organizations in those instances where there are no pollution abatement projects planned or underway.

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**4. ANNUAL SITE ENVIRONMENTAL REPORT.**

- a. **Purpose.** The purpose of this report is to present summary environmental data so as to characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts.
- b. **Extent.** Reports shall be prepared for all sites that conduct significant environmental protection programs. The breadth and detail should reflect the size and extent of any program at a particular site.
- c. **Reporting Criteria.** All DOE facilities that conduct significant environmental protection programs shall prepare an Annual Site Environmental Report. Environmental reports covering the previous calendar year shall be prepared annually and distributed by June 1 to EH-1 (10 copies), appropriate PSOs, the Office of Scientific and Technical Information, the Environmental Protection Agency, and to other agencies and organizations, as appropriate.
- d. **Content and Format.** Suggested content and format for the Annual Site Environmental Report is contained in Attachment II-1.

**5. REPORTS ON RADIOACTIVE EFFLUENT/ON-SITE DISCHARGE/UNPLANNED RELEASES.**

- a. **Radioactive Effluent and On-site Discharge Data Reports** covering the previous calendar year shall be submitted to the Waste Information Systems Branch, EG&G Idaho, Inc., Idaho Falls, Idaho 83415, by April 1; a copy of the cover letter shall be sent to EH-1. The reports, including the data forms, cover sheet, maps, and, if necessary, explanatory information shall be submitted in accordance with instructions provided in Section II of the Effluent Information System and On-site Discharge Information System User's Manual. Maps should be included only when they reflect modifications (terminations or startups, etc.) from previous years. The report shall consist of:
  - (1) A cover sheet listing the site, facility, report period, contractor(s), and address;
  - (2) A summary providing pertinent descriptive and interpretative information which would serve to explain any facets of the data which are not adequately described on the sheets. (Classified effluent data should be submitted on separate forms.);
  - (3) Maps, 8-1/2 x 11 inches, showing the locations of effluent streams and on-site discharge points;

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- (4) Completed DOE F 5821.1, "Radioactive Effluents/On-site Discharges/ Unplanned Releases," unless submitted via the Secure Automatic Communications Network (SACNET) or directly to the computer operations.
- b. Unplanned releases of radioactive materials in effluents, such as spills, leaks, etc., whether onsite or offsite, also shall be reported to the Information System Branch, EG&G Idaho, Inc., on Form DOE F 5821.1. This is in addition to meeting the occurrence reporting requirements of DOE 5000.3A. Releases of no environmental concern, including those that are subsequently cleaned up, need not be reported.
- c. Field Organizations should assure that any data errors on DOE F 5821.1 are reported promptly to the Information Systems Branch, EG&G Idaho, Inc., using amended forms.

Vertical line denotes change.

### SUGGESTED CONTENT AND FORMAT FOR ANNUAL SITE ENVIRONMENTAL REPORTS

Content and format for the Annual Site Environmental Report is provided below; guidelines and examples are included to illustrate the quality and kind of information required. The report should be of the high quality typical of DOE and contractor technical and public reports. The cover should be of appropriate quality and appearance, and the text printed and professionally edited. Where possible, pages illustrating figures, maps, etc. should be 8 1/2" x 11".

1. COVER PAGE. The cover page should include the site name, facility, reporting period, reporting organization, address, and document number. The report should be titled "(Name) Site Environmental Report for Calendar Year 19--."
2. TITLE PAGE. Same as for 1 above.
3. TABLE OF CONTENTS. The Table of Contents should list sections, locations of figures, texts, appendices, references, etc., in the document.
4. INTRODUCTION. The introduction should include a brief description of the site, its mission, the nature of its primary operations, and activities. A general discussion of environmental features and land and water use, including pertinent demographic information, should be included in this section.
5. SUMMARY. The summary should provide evaluation and interpretation of the information included in each of the sections (items 6-9 which follow) contained in the report; the meaning of these data should be explained in the context of applicable environmental standards and requirements. The summary should be written in a manner understandable to the general public. Explanations, as appropriate, should be included for unusual events or releases. A discussion of abnormal occurrences which resulted from or could have impact upon either the program activity or the site, should be included. Population dose estimates and the dose to the maximum exposed individual (where appropriate) should be included. The total quantity of radioactivity by radionuclide released as airborne and liquid effluents should be included, along with descriptive information on nonradioactive effluents.
6. COMPLIANCE SUMMARY. This section should review the facility's compliance record. Specific instances of noncompliance should be discussed and a description of corrective actions should be included.

7. **ENVIRONMENTAL PROGRAM INFORMATION.** This section should provide a summary of all of a site's environmental activities performed to comply with laws and regulations, to enhance environmental quality, and to improve understanding of the effects of environmental pollutants from site operations. Items to be included are:
- a. A summary of environmental monitoring performed. This should be a brief description of the types of monitoring performed; which regulations require it; number of stations, frequency, and parameters measured; to whom data are reported; and a summary of results compared to applicable standards. This summary should address programs for both radioactive and nonradioactive monitoring.
  - b. A listing of environmental permits issued to the site by Federal, state and local regulatory agencies. Include the type of permit, by whom issued, and the expiration date.
  - c. A listing of draft and final EISs and EAs completed during the year that pertain to site activities.
  - d. A summary of significant environmental activities at the site. This could include activities to meet permit or EIS requirements, new procedures implemented to comply with regulations, pollution abatement projects, and special studies of the fate and effect of pollutants from the site.
8. **ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION.** This section should provide an accurate description of the environmental radiological monitoring program conducted at each facility. For facilities that do not need to monitor for radioactivity in the environment, a "Not Applicable" response is sufficient
- a. **Radioactive Effluent Data.** Effluent data for radionuclides should be summarized. The nuclides of concern and the total number of curies in airborne and liquid effluents released to the offsite environment should be included in the portion of the report dealing with air and water monitoring, respectively. In instances where liquid effluents released to different receiving streams result in separate routes of potential exposure, the radioactivity discharged to each receiving stream should be identified. For purposes of reporting radiological effluent data, gross radioactivity measurements are unacceptable, unless specified by applicable federal, state, or local regulations.
  - b. **Environmental Sampling for Radioactivity.** Include a brief description of each of the media sampled as part of the monitoring program or as part of a special study. The type and frequency of sampling and the methods of analysis should be presented. Individual data points are not required, but tables, graphs, or text which clearly and accurately present the overall monitoring results should be provided. A map

showing the location of monitoring stations and sampling points also should be included. As a general rule, data should be presented for radioactivity in media for which there are applicable standards or other meaningful bases for interpreting the results. Interpretation should be made, where appropriate, of how the environmental levels (resulting from site operations) compare to relevant parameters such as background radioactivity, and applicable effluent or environmental standards.

- c. Reporting Potential Dose to the Public. The Environmental Report should contain an assessment of the potential radiation exposure to the public which could have resulted from site operations during the calendar year. The assessment should be as accurate and realistic as possible. The modeling and calculation methodology used in the dose assessment should be included or referenced. A comparison of results with applicable standards and relevant parameters (e.g., natural and manmade sources of exposure) also should be included.
- d. Reporting Units. The following units should be used in reporting radiological data:
  - (1) Air. uCi/ml (for tritium, report in pCi/ml; for uranium and thorium, also include pg/ml).
  - (2) Sediment. uCi/g or pCi/g dry weight. Specify sample depth and method of obtaining dry weight. For uranium and thorium, also include ug/g dry or wet weight, where possible. For tritium, the concentration may be expressed in uCi/ml of moisture content in unit volume of wet samples.
  - (3) Food and Vegetation. uCi/g or pCi/g dry weight. Specify percent moisture and method of obtaining dry weight. For tritium, the concentration may be expressed in uCi/ml of moisture content in unit volume of wet samples.
  - (4) Milk. uCi/ml.
  - (5) Penetrating Radiation. mrem/yr.
  - (6) Soil. Three possible reporting units:
    - (a) uCi/m<sup>2</sup> (or pCi/m<sup>2</sup>). Specify sample depth or profile depth. For tritium, the concentration may be expressed in uCi/ml of soil moisture;

- (b) uCi/g (or pCi/g) dry weight. Specify sample depth and method of obtaining dry weight;
- (c) For uranium and thorium, also include ug/g dry or wet weight.

(7) Water. uCi/ml.

9. ENVIRONMENTAL NON-RADIOLOGICAL PROGRAM INFORMATION. This section should provide an accurate description of the environmental non-radiological monitoring program conducted at each facility. For facilities that do not need to monitor non-radiological pollution, a "Not Applicable" response is sufficient.

- a. Effluent Data. Effluent monitoring data should be summarized. Pollutants of concern and discharge volumes in airborne and liquid effluents released to the environment should be included in the portion of the report dealing with air and water monitoring, respectively.
- b. Environmental Sampling for Non-Radiological Pollution. Include a brief description of each of the media sampled as part of the monitoring program or as part of a special study. The type and frequency of sampling and the methods of analysis should be presented. Individual data points are not required, but tables, graphs, or text which clearly and accurately present the overall monitoring results should be provided. A map showing the location of monitoring stations and sampling points also should be included.

As a general rule, data should be presented for which there are applicable standards or other meaningful bases for interpreting the results. Interpretation should be made, where appropriate, of how the environmental levels (resulting from site operations) compare to relevant parameters such as background levels, and applicable effluent or environmental standards.

- c. Reporting Units. In reporting non-radiological data, units should agree with those specified by the analytical methods. Where applicable, reporting units should agree with the units specified on permits issued under regulatory programs.

10. GROUNDWATER PROTECTION. The groundwater protection program should be summarized, including a review of the monitoring program that describes the number of wells, sampling method, sampling frequency, analyses performed and a summary of results. There also should be a summary of the hydrogeology of the site, major aquifers, movement of groundwater, potential sources of groundwater pollution, and uses of groundwater in the vicinity of the site.

11. QUALITY ASSURANCE. A quality assurance section should summarize the measures taken to ensure the quality of monitoring data. The overall program, including sampling, analysis, and data management, should be described for both radioactive and nonradioactive effluent and environmental monitoring. A summary of results from participation in interlaboratory cross-check programs should be included, listing site results and expected results.
12. REFERENCES. A section should list applicable references and other documents cited in the body of the report.
13. DISTRIBUTION LIST. A standard distribution list of those persons or organizations receiving copies of the report should be included.

### CHAPTER III

#### ENVIRONMENTAL PROTECTION PROGRAM PLANS

1. PURPOSE. This Chapter establishes requirements for DOE operations to develop and implement specific program plans for each facility or group of facilities for which they are responsible. The Office of Fossil Energy shall be responsible for developing these plans for operations under its direct cognizance.
2. IMPLEMENTATION PLAN. Each field organization shall prepare a plan for implementing the requirements of this Order. An implementation plan shall be prepared for each facility or group of facilities, the purpose of which is to provide management direction, including assignment of responsibilities and authorities, to ensure that all DOE facilities are operated and managed in a manner that will protect, maintain, and, where necessary, restore environmental quality, minimize potential threats to the environment and the public health, and comply with environmental regulations and DOE policies. Specifically, the implementation plan shall:
  - a. Provide environmental protection goals and objectives for the organization, and identify strategies and timetables for attaining them. Organization and staffing, including assignment of responsibilities for environmental activities, policies, facility operating procedures, and budgeting, will be described.
  - b. Provide an overall framework for the design and implementation of an environmental protection program for each DOE facility; and
  - c. Assign responsibilities for complying with requirements under all Federal, state and local environmental laws and/or regulations for all DOE facilities.
  - d. The implementation plan shall be prepared no later than 12 months after the effective date of this Order and shall be updated annually. The plan shall be approved by the appropriate PSO, with concurrence by EH-1.
3. LONG RANGE ENVIRONMENTAL PROTECTION PLAN. As an element of its long range ES&H planning, each field organization shall develop a long range environmental protection plan that comprehensively defines specific environmental objectives and the means and schedules for attaining objectives and completing programs and projects at each facility or group of facilities. Information contained in this plan will be integrated into the appropriate PSO planning, support environmental program budget requests, and provide the basis for comprehensive PSO environmental long range planning. The plan will serve as a mechanism for Headquarters and field organizations to coordinate strategies for addressing environmental needs.

a. The plan shall:

- (1) Identify requirements;
- (2) Compare operations against requirements to identify needs;
- (3) Establish strategies for meeting identified needs;
- (4) Identify activities required to implement the strategies; and
- (5) Identify needed resources and develop a schedule to accomplish those activities.

b. Specific guidance for preparing the plan will be issued by EH-1. Each plan will be submitted to the appropriate PSO, EH-1, and MA-1.

4. SPECIAL PROGRAM PLANNING REQUIREMENTS. In addition to other program requirements and documentation required in this Order, each Head of Field Organization shall prepare a separate plan of sufficient scope and detail to reflect program significance, as appropriate, for each of the following activities.

- a. A Groundwater Protection Management Program that includes, for each site, the following: (1) documentation of the groundwater regime with respect to quantity and quality; (2) design and implementation of a groundwater monitoring program to support resource management and comply with applicable environmental laws and regulations; (3) a management program for groundwater protection and remediation, including specific Safe Drinking Water Act (SDWA), Resource Conservation and Recovery Act (RCRA) and CERCLA actions; (4) a summary and identification of areas that may be contaminated with hazardous substances; (5) strategies for controlling sources of these contaminants; (6) a remedial action program that is part of the site CERCLA program required by DOE 5400.4; (7) decontamination and decommissioning, and other remedial programs contained in DOE directives. Plans, permits, and other technical documents such as those associated with compliance with the SDWA, RCRA, and CERCLA may be used in whole or in part to satisfy this requirement. This plan shall be completed no later than 18 months after the effective date of this Order. The plan shall be reviewed annually and updated every 3 years.
- b. A Waste Minimization Program that will contain goals for minimizing the volume and toxicity of all wastes that are generated, with annual reductions if programmatic requirements allow. Changes in waste quantity, volume and toxicity that are achieved shall be compared with quantities generated in the previous year. The proposed methods of treatment, storage, and disposal that accomplish waste minimization that are technically and economically practicable shall be reported as appropriate. Waste minimization plans required by specific legislation.

CHAPTER IV  
ENVIRONMENTAL MONITORING REQUIREMENTS

1. PURPOSE.

- a. This Chapter contains requirements and guidance for environmental monitoring programs concerned with: (1) measuring and monitoring effluents from DOE operations; and (2) surveillance through measurement, monitoring, and calculation of the effects of those operations on the environment and public health. The objectives of the monitoring programs are to: demonstrate compliance with legal and regulatory requirements imposed by applicable Federal, State and local agencies; confirm adherence to DOE environmental protection policies; and support environmental management decisions. A critical element of monitoring is quality assurance and verification. Each DOE Facility is unique; therefore, the need and levels of effort for monitoring programs shall be determined by the appropriate field organization on a case-by-case basis, consistent with regulatory requirements, DOE directives, and the degree of environmental assurance that activities at the particular site require.
- b. All requirements contained in Chapter IV shall be implemented no later than 36 months after the effective date of this Order, unless otherwise required by other DOE Orders, or by applicable Federal, State, or local legislation or regulation.
- c. Monitoring requirements for radioactivity are contained in DOE Orders in the 5400 series dealing with radiation protection of the public and the environment.

2. APPLICABILITY.

- a. The following environmental monitoring requirements apply: (1) those contained in DOE Orders in the 5400 series dealing with radiation protection of the public and the environment, and DOE 5820.2; and (2) those specified by applicable Federal, State, or local regulations.
- b. To the extent that a regulation or permit allows for exemptions from required monitoring practices and procedures, Heads of Field Organizations shall obtain approval for any exemption from the appropriate regulatory agency. In those instances where an exemption from a DOE-imposed monitoring requirement is justifiable, approval shall be granted by the appropriate Head of Field Organization. The procedures contained in page I-1, paragraph 4 of this Order are not applicable to any exemptions that are made for environmental monitoring requirements.

**PREOPERATIONAL MONITORING OF FACILITIES, SITES, AND OPERATIONS.** An environmental study shall be conducted prior to start up of a new site, facility, or process which has the potential for significant adverse environmental impact. The preoperational study should begin not less than 1 year, and preferably 2 years before start up to evaluate seasonal changes. The study shall serve to: characterize existing physical, chemical, and biological conditions that could be affected; establish background levels of radioactive and chemical components; characterize pertinent environmental and ecologic parameters; and identify potential pathways for human exposure or environmental impact as a basis for determining the nature and extent of the subsequent routine operational and emergency effluent monitoring and environmental surveillance programs. Where time and circumstances do not allow for completion of preoperational monitoring prior to start-up, it shall be conducted concurrent with work on the new site, facility, or process. The preoperational study shall be consistent with NEPA compliance activities. Where appropriate, activities and documentation conducted for NEPA compliance may substitute for compliance with this requirement.

4. **ENVIRONMENTAL MONITORING PLANS.** A written environmental monitoring plan shall be prepared for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. The plan shall contain the rationale and design criteria for the monitoring program, extent and frequency of monitoring and measurements, procedures for laboratory analyses, quality assurance requirements, program implementation procedures, and direction for the preparation and disposition of reports. The plan shall be approved by the appropriate Head of Field Organization, or his or her designee. The plan shall be reviewed annually and updated as needed. The plan shall identify and discuss two major activities: (a) effluent monitoring, and (b) environmental surveillance. The plan shall reflect the importance of monitoring as a critical element of an effective environmental protection program. The plan shall be reviewed annually and updated every 3 years.

5. **ENVIRONMENTAL MONITORING - GENERAL REQUIREMENTS.** Environmental monitoring shall consist of two major activities: effluent monitoring and environmental surveillance. Selected references for environmental monitoring are listed in Attachment IV-1.

a. **Effluent Monitoring.**

- (1) Effluent monitoring shall be conducted at all DOE sites to satisfy the following program objectives:
- (a) Verify compliance with applicable Federal, State, and local effluent regulations and DOE Orders.
  - (b) Determine compliance with commitments made in Environmental Impact Statements, Environmental Assessments, or other official documents.

- (c) Evaluate the effectiveness of effluent treatment and control.
- (d) Identify potential environmental problems and evaluate the need for remedial actions or mitigation measures.
- (e) Support permit revision and/or reissuance.
- (f) Detect, characterize, and report unplanned releases.
- (2) Effluent monitoring shall comply with applicable regulations and shall be conducted to provide representative measurements of the quantities and concentrations of pollutants in liquid and airborne discharges, and solid wastes.
  - (a) Monitoring Stations. Effluents from on-site waste treatment or disposal systems shall be monitored in accordance with applicable regulations. Influent to on-site waste treatment or disposal systems should be monitored as needed.
  - (b) Sampling. Sample collection programs shall reflect specific facility needs. Type and frequency of sampling shall be adequate to characterize effluent streams.
  - (c) Sample Analysis. Standard analyses shall be used to analyze samples whenever such methods are required by regulatory programs. Exemptions due to analytical problems or for non-routine analyses may be employed after receiving approval from the appropriate regulatory agency. Analyses not required by regulations may be conducted as determined by site-specific conditions.
  - (d) Monitoring Data Recordkeeping. Auditable records shall be established in accordance with the requirements of DOE 5700.6B.

b. Environmental Surveillance.

- (1) Environmental surveillance shall be conducted to monitor the effects, if any, of DOE activities on on-site and offsite environmental and natural resources. An environmental surveillance screening program shall be undertaken at DOE sites to determine the need for a permanent surveillance program. Environmental surveillance shall be designed to satisfy one or more of the following program objectives:
  - (a) Verify compliance with applicable environmental laws and regulations;

- (b) Verify compliance with environmental commitments made in Environmental Impact Statements, Environmental Assessments, Safety Analysis Reports, or other official DOE documents;
  - (c) Characterize and define trends in the physical, chemical and biological condition of environmental media;
  - (d) Establish baselines of environmental quality;
  - (e) Provide a continuing assessment of pollution abatement programs;
  - (f) Identify and quantify new or existing environmental quality problems.
- (2) Environmental surveillance programs and components should be determined on a site-specific basis by the field organization. Programs should reflect facility characteristics, applicable regulations, hazard potential, quantities and concentrations of materials released, the extent and use of affected air, land, and water, and specific local public interest or concern. Surveillance programs are likely to include one or more of the following:
- (a) Monitoring stations;
  - (b) Sampling and analysis; and
  - (c) Monitoring data recordkeeping.

6. METEOROLOGICAL MONITORING PROGRAM. Representative meteorological data are required at DOE facilities to support environmental monitoring activities. This information is essential to characterize atmospheric transport and diffusion conditions in the vicinity of the DOE facility and to represent other meteorological conditions (e.g., precipitation, temperature, and atmospheric moisture) which are important to environmental surveillance activities such as air quality and radiation monitoring.

- a. Meteorological Information/Monitoring Programs. A meteorological information/monitoring program shall be developed as a specific element of all environmental monitoring plans. The program shall identify types of meteorological information required to support all environmental protection activities (both routine and non-routine) and the regulations applicable to assessing impacts of airborne releases. The elements of the program (e.g., acquisition, analysis, and data management) shall be specified and the rationale or purpose for selecting those elements documented.

- b. General Requirements. Representative meteorological information shall be available at or in the vicinity of DOE facilities to:
- (1) Provide data to characterize atmospheric transport, diffusion conditions, and other climatic conditions of importance in the vicinity of the DOE facility for assessments of the impacts of airborne releases (both routine and non-routine) on public health and safety;
  - (2) Provide data to characterize conditions important to environmental surveillance activities such as air quality and radiation monitoring;
  - (3) Provide data to confirm compliance with and implementation of applicable regulations and DOE Orders; and
  - (4) Provide a consistent data base upon which decisions can be made concerning airborne releases and appropriate control activities.

7 RADIOLOGICAL MONITORING.

- a. Requirements for the environmental monitoring of radioactive materials are to be found in DOE Orders in the 5400 series dealing with radiation protection of the public and the environment. Airborne radiation and radioactive materials discharged from DOE facilities shall comply with the requirements of 40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants." Further, for those radioactive materials not regulated under the Clean Air Act, DOE has established standards to meet its responsibilities under the Atomic Energy Act.
- b. An assessment of the potential radiation dose to members of the public which could have resulted from site operations shall be made for facilities required to conduct effluent and environmental radiological monitoring. Assessments shall be made in accordance with the requirements of DOE Orders in the 5400 series dealing with radiation protection of the public and the environment.

8. NON-RADIOLOGICAL MONITORING.

a. Air Monitoring - Emissions.

- (1) Air emission monitoring shall be in accordance with the requirements of applicable Federal, State, and local regulations authorized by the Clean Air Act (42 U.S.C. 7401, et. seq.). Section 118 of the Act specifically addresses the control of airborne pollution from federal facilities. Design of air quality monitoring programs should be undertaken with a thorough understanding of the complex framework of air quality management.

- (2) Where applicable, DOE facilities shall comply with monitoring requirements discussed in 40 CFR Part 60, which includes monitoring of fossil fuel combustion sources and associated test methods. Appendix A of 40 CFR Part 60 provides methods referred to in 40 CFR Part 60.8 (Performance Tests) and 40 CFR Part 60.11 (Compliance with Standards and Maintenance Requirements).
- (3) Large permanent facilities or modification to such facilities may require a Prevention of Significant Deterioration (PSD) permit prior to construction. In addition to pre- and post-operational emission testing, the permit process may require up to a year of meteorological and ambient air quality monitoring. Monitoring shall conform to the EPA PSD monitoring regulations (40 CFR Part 58) which contain siting, quality assurance, and accuracy requirements. Siting of monitoring stations requires the use of atmospheric dispersion modeling to locate areas of expected maximum offsite impact. The rules also identify specific reference methods and equivalent method analyses which shall be used for the program.

b. Air Monitoring - Environmental Surveillance.

- (1) Ambient air quality monitoring programs should be designed to accomplish the following:
  - (a) Establish background concentration levels of pertinent chemical species;
  - (b) Determine the highest concentrations of the pertinent pollutant species expected to occur in the vicinity of DOE operations;
  - (c) Determine representative pollutant concentrations at areas where public health and other concerns should be considered; and
  - (d) Evaluate the effects of emissions on ambient levels of pertinent contaminants.
- (2) Where possible, background data should be gathered from existing State and Local Air Monitoring Stations (SLAMS) which are required by 40 CFR Part 58.20 to be provided for in a State's implementation plan. Design considerations for siting any supplementary air quality monitoring stations should include emissions, meteorology and climatology, topography, and geography. Specific requirements associated with ambient air quality monitoring are found in regulations promulgated by EPA. Particular attention shall be given to the following:

- (a) 40 CFR Part 50, "National Primary and Secondary Ambient Air Quality Standards"
- (b) 40 CFR Part 52, "State Implementation Plans"
- (c) 40 CFR Part 53, "Ambient Air Monitoring Reference and Equivalent Methods"
- (d) 40 CFR Part 58, "Ambient Air Quality Surveillance"

c. Water Monitoring - Effluents.

- (1) Under the authority of the Clean Water Act (33 U.S.C. 1251, et seq.), EPA has promulgated regulations for monitoring liquid effluent discharges. In the National Pollutant Discharge Elimination System (NPDES) established by section 402, the EPA Administrator, or States with approved programs, after opportunity for public hearing, issues permits that control and limit the discharge of any pollutant to the waters of the United States.
- (2) Where required, DOE facilities shall monitor liquid effluent discharges. Federal regulations defining NPDES requirements for monitoring nonradioactive effluents appear in the following:
  - (a) 40 CFR Part 123, "State Program Requirements"
  - (b) 40 CFR Part 124, "Procedures for Decisionmaking"
  - (c) 40 CFR Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System"
  - (d) 40 CFR Part 129, "Toxic Pollutant Effluent Standards"
- (3) NPDES permits contain specific and legally enforceable effluent limitations and self-monitoring requirements for flow measurement and sampling.
- (4) In addition to rules promulgated under the Clean Water Act, DOE facilities shall satisfy monitoring requirements called for under the Resource Conservation and Recovery Act (RCRA), as amended, since under RCRA, a solid waste can be a liquid. Under RCRA, it shall first be determined if a waste is hazardous. If a waste is determined to be hazardous, the applicable regulations in 40 CFR Parts 260 through 280 shall be implemented.

**d. Water Monitoring - Environmental Surveillance.**

- (1) Ambient water quality monitoring should be conducted through a network of fixed stations from which data will establish well-defined histories of the physical, biological, and chemical conditions of local bodies of water and sediments. The data obtained from this network should be coordinated with other monitoring activities. Water quality data may be obtained from existing State and local monitoring stations.
- (2) Analysis of data collected from a fixed station monitoring network should support:
  - (a) Characterizing and defining trends in the physical, chemical, and biological condition of surface waters;
  - (b) Establishing baselines of water quality;
  - (c) A continuing assessment of water pollution control programs.
  - (d) Identifying new water quality problems; and
  - (e) Detecting, characterizing, and reporting unplanned releases and their effects on water quality.
- (3) Monitoring networks should be operated and maintained in a uniform manner, i.e., through established procedures that allow comparative evaluations of data from monitoring sites. Receiving water characteristics will determine the location of stations. A reconnaissance survey might be sufficient in siting stations. Under complex circumstances, mathematical models could be needed to select stations sites.
- (4) Monitoring programs are best served by fixed station networks. However, a network of effluent monitoring and selected mobile monitoring stations could satisfy the needs at some facilities.
- (5) Surface water sampling performed at fixed monitoring stations will characterize physical and chemical properties of the water column and sediments, and biological species in the water column and benthos. Types of sampling performed should depend upon local conditions and the variability of stream characteristics and water quality.
- (6) The monitoring frequency at a fixed network station is a function of the variability of the chemical, physical, and biological conditions of the water body. Data collected shall be representative of the variations in water quality and changes in pollutant loads. Varying sampling frequencies could be required

to accurately reflect seasonal changes, variable pollution sources, time of water travel between stations, and tidal and diurnal variations.

- (7) Ambient water quality monitoring serves to confirm compliance with the Clean Water Act. An understanding of the Water Quality Management (WQM) process implemented by EPA, the States, interstate agencies, and area-wide, local and Regional planning organizations is essential to the design of a water quality monitoring program. The elements of the WQM processes are described in 40 CFR Part 130. Test procedures for pollutant analyses are listed in the 40 CFR Part 136.

9. GROUNDWATER MONITORING PROGRAM. Groundwater that is or could be affected by DOE activities shall be monitored to determine and document the effects of operations on groundwater quality and quantity and to demonstrate compliance with DOE requirements and applicable Federal, State, and local laws and regulations.

- a. Groundwater Monitoring Plans. A groundwater monitoring plan shall be developed as a specific element of all environmental monitoring plans and the Groundwater Protection Management Program required in page III-2, subparagraph 4a. The plan shall identify all DOE requirements and regulations applicable to groundwater protection and include monitoring strategy. The elements of the groundwater monitoring program shall be specified (sampling plan, sampling, analysis, and data management), as shall the rationale or purpose for selecting these elements.

- b. General Requirements. Groundwater monitoring programs shall be conducted on-site and in the vicinity of DOE facilities to:

- (1) Obtain data for the purpose of determining baseline conditions of groundwater quality and quantity;
- (2) Demonstrate compliance with and implementation of all applicable regulations and DOE Orders;
- (3) Provide data to permit the early detection of groundwater pollution or contamination;
- (4) Provide a reporting mechanism for detected groundwater pollution or contamination.
- (5) Identify existing and potential groundwater contamination sources and to maintain surveillance of these sources;
- (6) Provide data upon which decisions can be made concerning land disposal practices and the management and protection of groundwater resources.

- c. Site-specific characteristics shall determine monitoring needs. Where appropriate, groundwater monitoring programs shall be designed and implemented in accordance with 40 CFR Part 264, Subpart F, or 40 CFR Part 265, Subpart F. For sites with multiple groundwater pollutant sources, extensive groundwater pollution or other unique site problems, groundwater monitoring programs could require more extensive information than those specified in 40 CFR Parts 264 and 265. Monitoring for radionuclides shall be in accordance with DOE Orders in the 5400 series dealing with radiation protection of the public and the environment.

#### 10. QUALITY ASSURANCE AND DATA VERIFICATION.

- a. Quality Assurance. A quality assurance program consistent with DOE 5700.6B shall be established covering each element of environmental monitoring and surveillance programs commensurate with its nature and complexity. The quality assurance program shall include, but not be limited to, the following:
- (1) Organizational responsibility;
  - (2) Program design;
  - (3) Procedures;
  - (4) Field quality control;
  - (5) Laboratory quality control;
  - (6) Human factors;
  - (7) Recordkeeping;
  - (8) Chain-of-custody procedures;
  - (9) Audits;
  - (10) Performance reporting; and
  - (11) Independent data verification.
- b. Laboratory Certification. DOE and DOE contractor laboratories shall confirm the need and apply for any certification requirements with appropriate Federal, State or local agencies. Where DOE operations secure the support of outside contractor laboratories, this work shall be conducted by appropriately certified laboratories.

- c. DOE Laboratory Quality Assessment Program for Radioactive Material. All DOE and contractor laboratories that conduct analytical work in support of DOE environmental radiological monitoring programs for radioactive materials shall participate in the DOE interlaboratory quality assurance program coordinated by the DOE Environmental Measurements Laboratory, New York, New York. Guidelines and procedures for this program shall be issued annually by EH-1.
- d. Independent Data Verification. EH-1, in consultation with the appropriate PSO and field organization shall develop an independent data verification program as a part of environmental monitoring programs at DOE facilities. The program shall be in place no later than twelve months after the effective date of this Order.

SELECTED REFERENCES FOR ENVIRONMENTAL MONITORING

1. 40 CFR Part 60. "Standards of Performance for New Stationary Sources."
2. 40 CFR Part 61. "National Emission Standards for Hazardous Air Pollutants."
3. 40 CFR Part 125. "Criteria and Standards for the National Pollutant Discharge Elimination System."
4. 40 CFR Part 129. "Toxic Pollutant Effluent Standards."
5. 40 CFR Part 130. "Water Quality Planning and Management."
6. 40 CFR Part 136. "Guidelines Establishing Test Procedures for the Analysis of Pollutants."
7. 40 CFR Part 146. "Underground Injection Control Program: Criteria and Standards."
8. 40 CFR Part 264. "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities."
9. 40 CFR Part 265. "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities."
10. MCD-51. NPDES Compliance Sampling Inspection Manual. U.S. Environmental Protection Agency, 1979
11. EPA 600/4-82-029. Handbook for Sampling and Sample Preservation of Water. U.S. Environmental Protection Agency, 1982.
12. EPA-600/4-79-020. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, 1979.
13. EPA-600/7-77-088. Handbook for Analytical Quality Control in Radioanalytical Laboratories. U.S. Environmental Protection Agency, 1977
14. EPA-550/7-77-14. Quality Control for Environmental Measurements Using Gamma-Ray Spectrometry. Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1977
15. EPA 600/4-84-017. Technical Addition to Methods for the Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, 1984.
16. EPA 600/4-84-077. Characterization of Hazardous Waste Sites - A Methods Manual. U.S. Environmental Protection Agency, 1984

17. SW-846, Test Methods for Evaluating Solid Waste, U.S. Environmental Protection Agency, 1986
18. Guidance for Air Quality Monitoring Network Design and Instrument Siting (40 CFR Part 58, Appendices D and E), U.S. Environmental Protection Agency, January 1974.
19. SW-611, Procedures Manual for Groundwater Monitoring at Solid Waste Facilities, U.S. Environmental Protection Agency, 1977.
20. OSWER-9950.1, RCRA Groundwater Monitoring Technical Enforcement Guidance Document, U.S. Environmental Protection Agency, 1986.
21. FMSL-LV-0539-17, Radiochemical Analytical Procedures for Analysis of Environmental Samples, U.S. Environmental Protection Agency, 1979.
22. NEIC Manual for Groundwater/Surface Investigations Center, U.S. Environmental Protection Agency, 1981.
23. Methods of Air Sampling and Analysis, APHA Intersociety Committee, Morris Katz, editor, 1983.
24. ANSI N.13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, American National Standards Institute.
25. Standard Methods for the Examination of Water and Waste Waters, 16th Edition, 1985, et. seq., APHA-AWWA-WPCF.
26. HASL-300, HASL Procedures Manual, Environmental Measurements Laboratory.
27. Manual of Groundwater Sampling Procedures, National Water Well Association, Worthington, Ohio, 1981
28. Groundwater Monitoring, L.G. Everett, General Electric Company, Schenectady, NY, 1980.
29. Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations)--Effluent Streams and the Environment, Revision 1, U.S. Nuclear Regulatory Commission, Office of Standards Development, Washington, DC, 1979.
30. IDO-12096, Radiological and Environmental Sciences Laboratory Analytical Chemistry Branch Procedures Manual, U.S. Department of Energy, Idaho Falls, ID, 1982

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31. ANSI N.42.18-1980. Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents. American National Standards Institute.
32. Air Pollutant Sampling and Analysis Deskbook. Cheremisinoff 1979.
33. AIRDOS-EPA: A Computerized Methodology for Estimating Environmental Concentrations and Doses to Man from Airborne Releases of Radionuclides. Oak Ridge National Laboratory. ORNL-5532.
34. Test Report: Particulate Sampling Strategy in Circular Ducts. J. Brown and K. Yu. Emission Measurement Branch, Emissions Standards and Engineering Division, U.S. Environmental Protection Agency. 1980.
35. GPO 055-000-00240-1. Permit Applicants Guidance Manual for Hazardous Land Treatment, Storage and Disposal Facilities. U.S. Environmental Protection Agency. 1984.
36. EPA 600/4-79-019. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. U.S. Environmental Protection Agency. 1979
37. EPA 450/2-78-027 R. Guideline on Air Quality Models (Revised). U.S. Environmental Protection Agency. 1986.
38. EPA 600/8-78-017. Microbiological Methods for Monitoring the Environment. Water and Waste. U.S. Environmental Protection Agency. 1978.
39. Identification of Technical Guidance Related to Groundwater Monitoring. Oak Ridge National Laboratory. Environmental Sciences Division. June 1986
40. EPA-520/5-84-006. Radiochemistry Procedures Manual. U.S. Environmental Protection Agency. 1984.